

Modern Refrigeration & Air Control

Vol. 62 No. 739

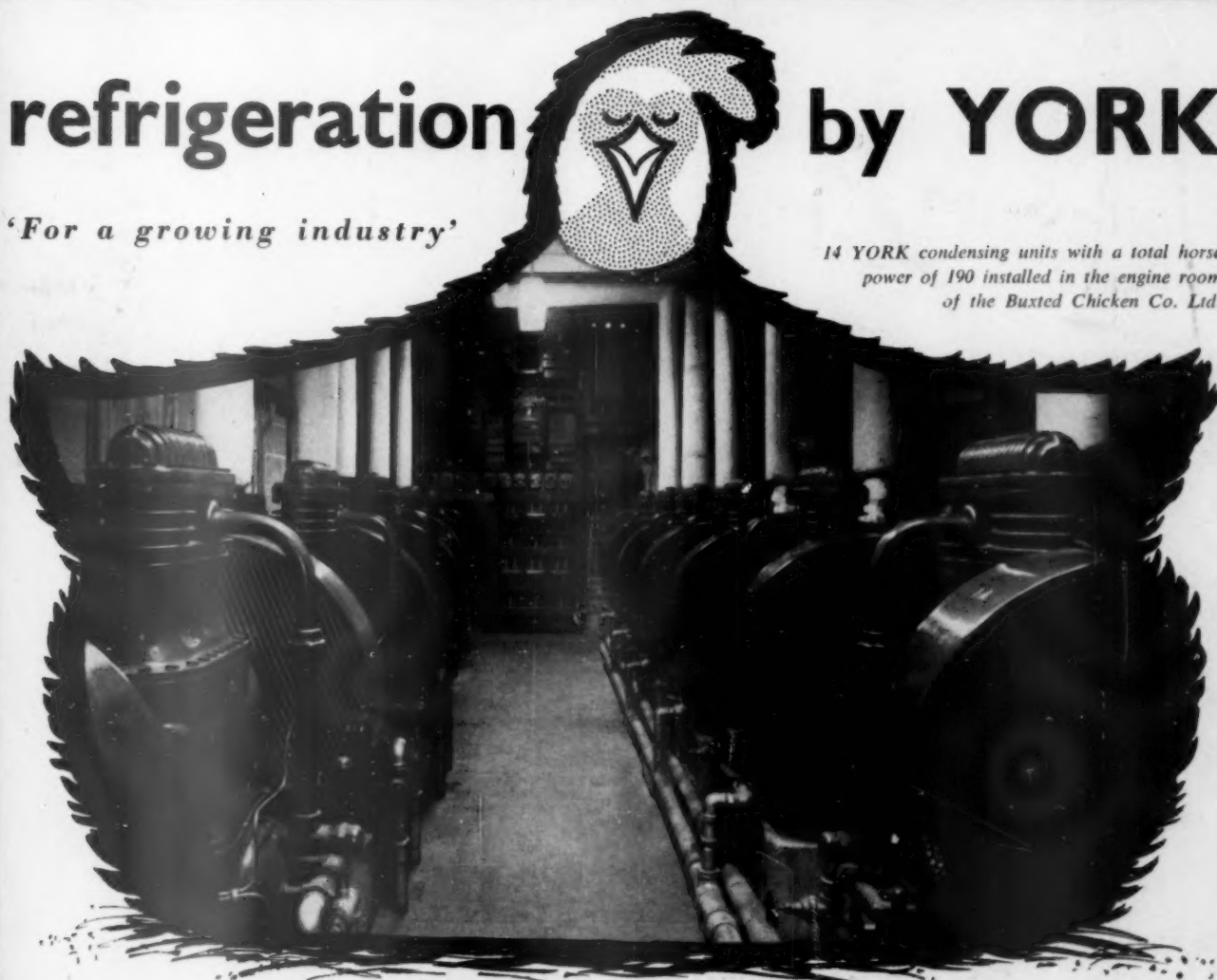
OCTOBER, 1959

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This ensures maximum heat-exchange efficiency and eliminates any risk of mechanical failure.

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'TUBE-IN-STRIP'

'INTEGRON' HIGH-FIN AND LOW-FIN TUBING



IMPERIAL CHEMICAL INDUSTRIES LIMITED, LONDON, S.W.1

KL-24A



The photograph shows two compressors out of six in a two-stage installation serving a number of ice-cream hardening tunnels. The premises are those of Messrs. Nilsens (Ice Cream & Frozen Foods) Ltd., by whose courtesy this photograph is reproduced.

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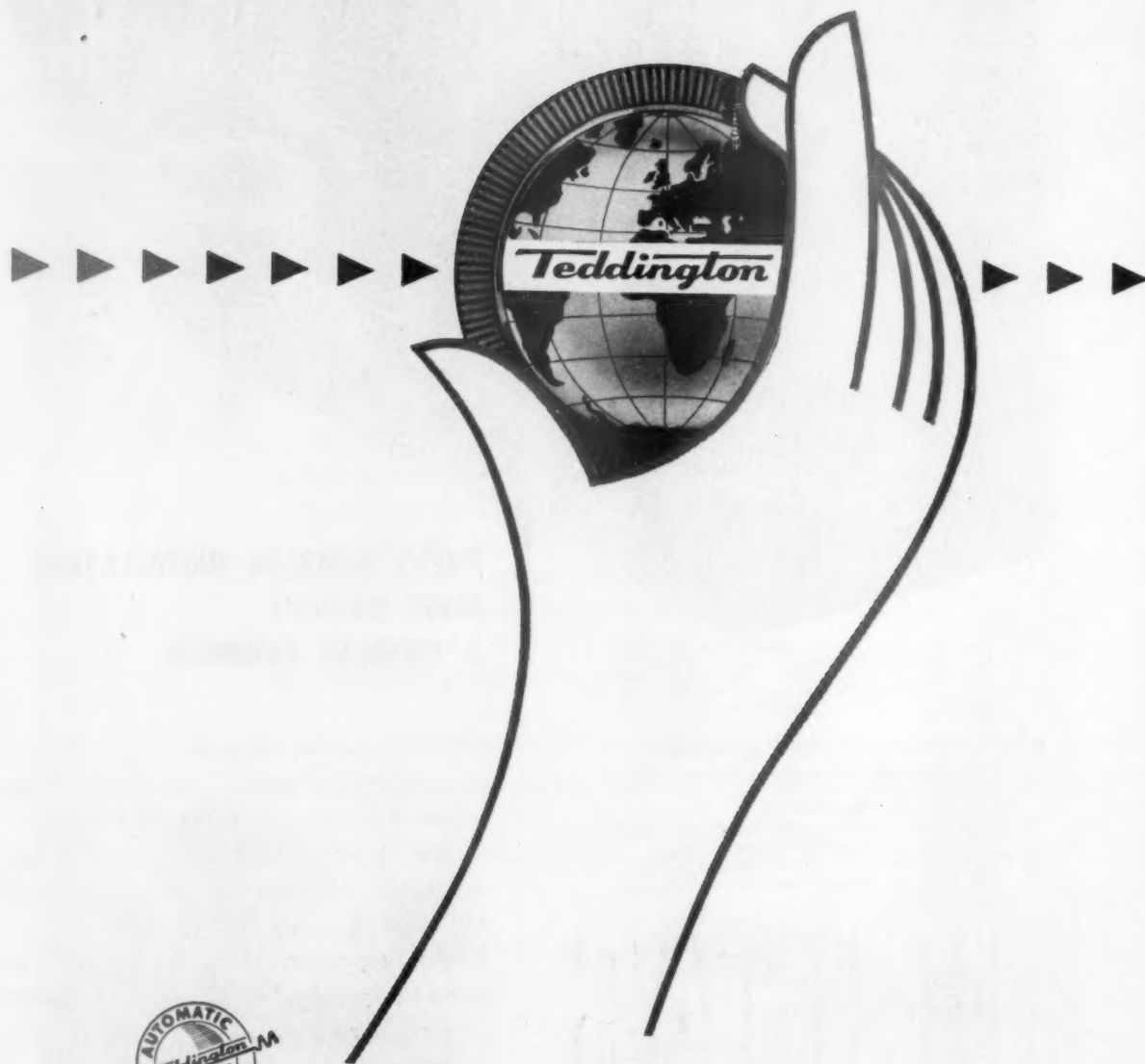
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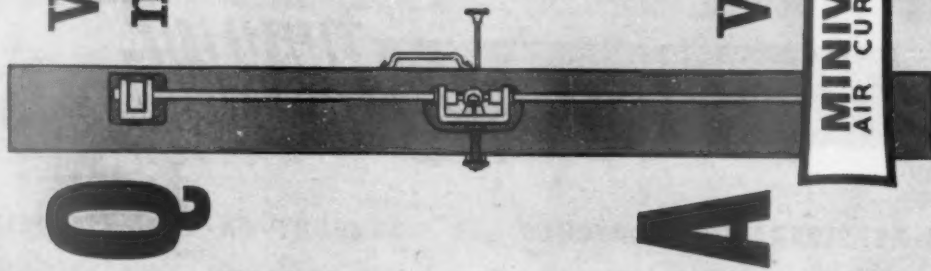
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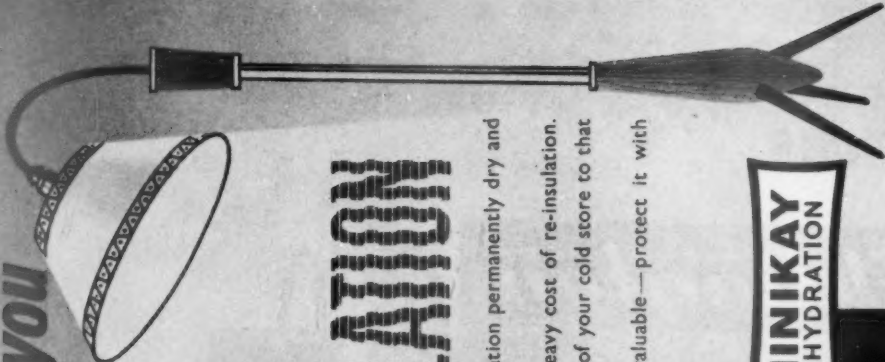
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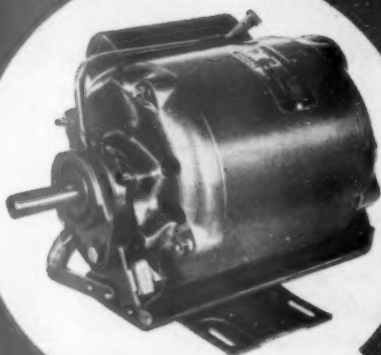
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starts with a

DELCO

electric
motor

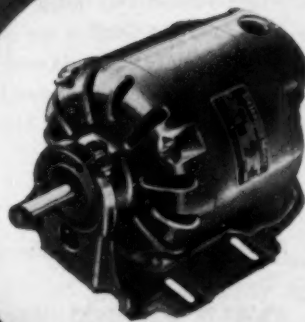


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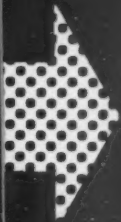
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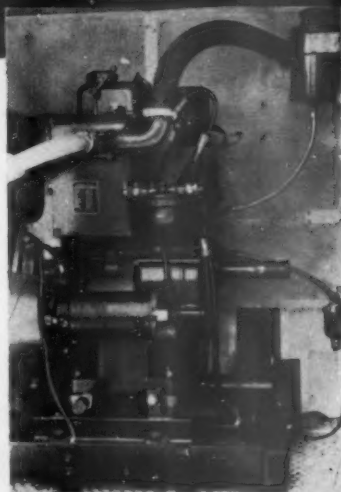
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AIR-COOLED DIESEL

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IMPERIAL**

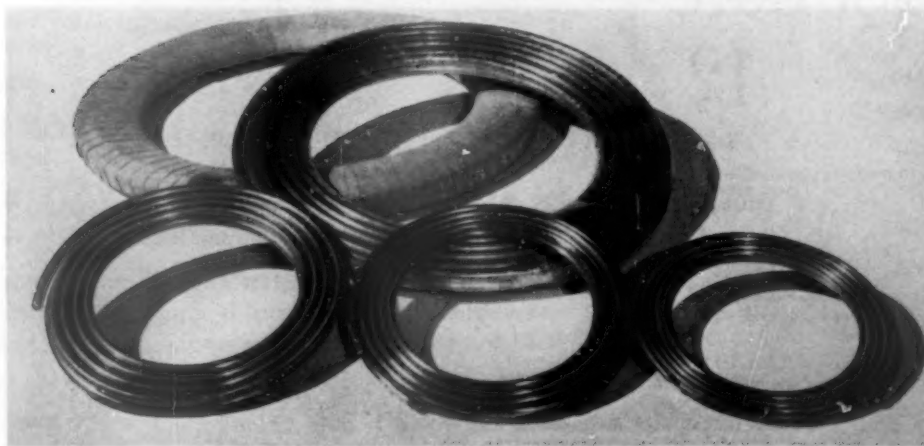
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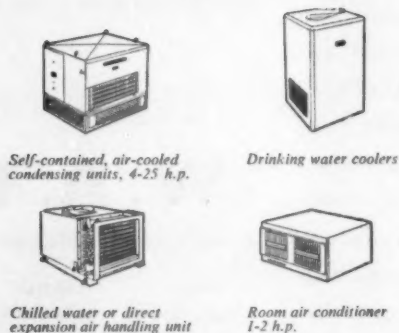


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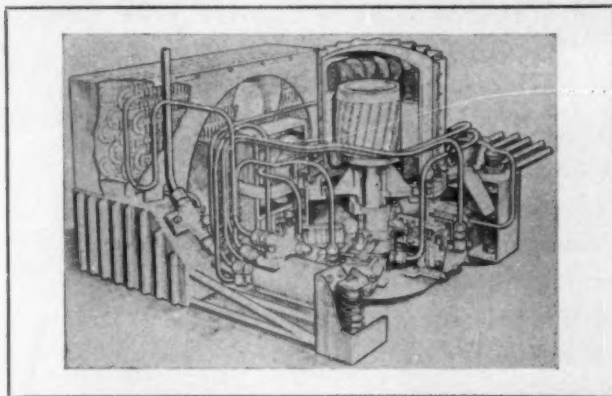
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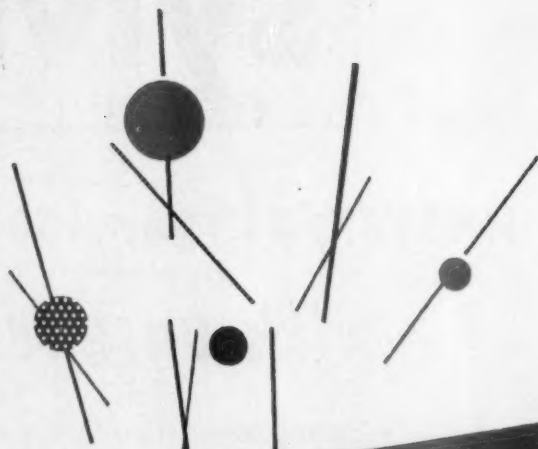
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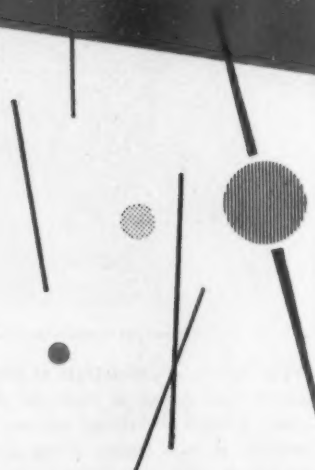
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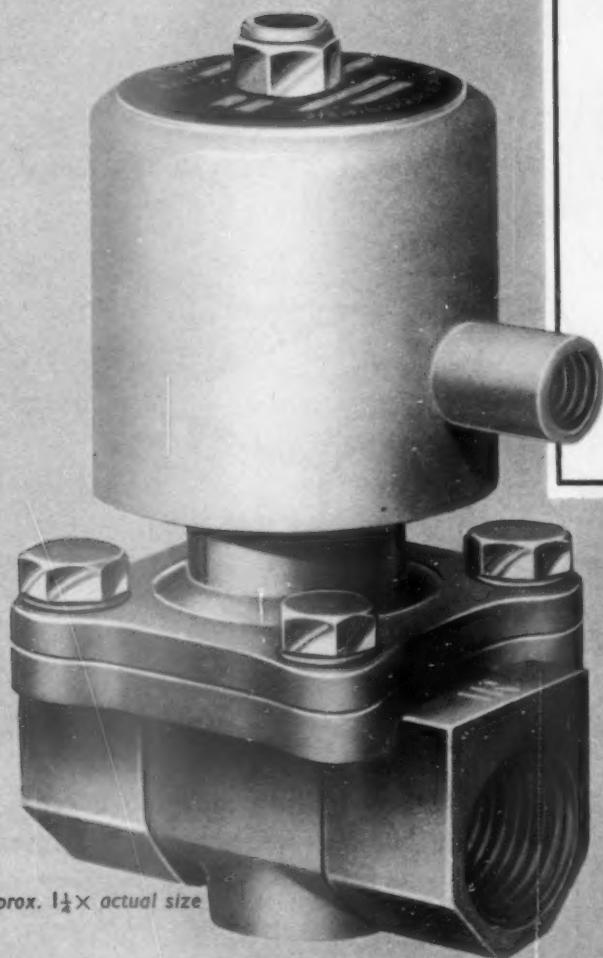
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Approx. $1\frac{1}{2} \times$ actual size

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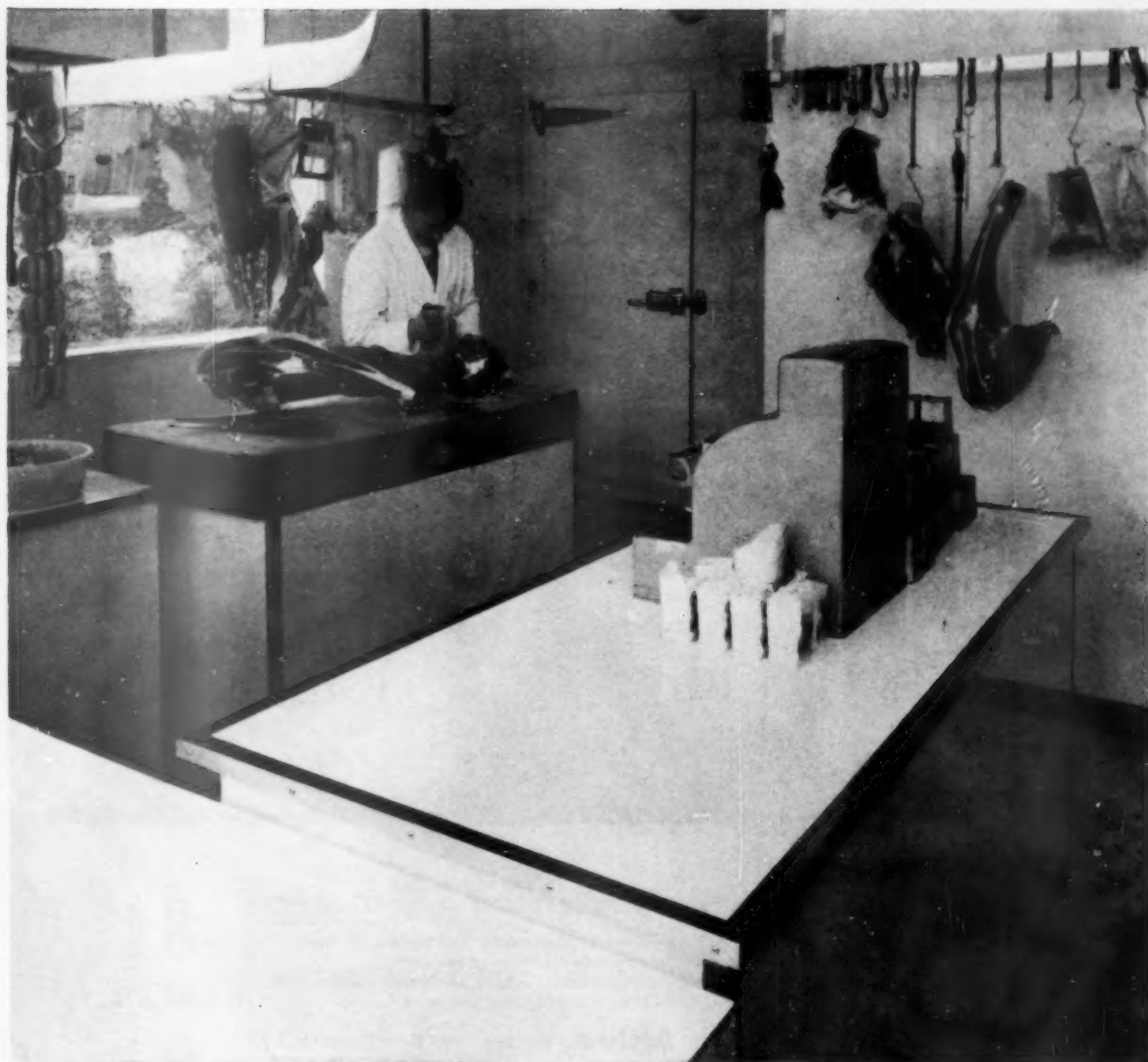
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- ★ One DANIELS frame-interchange machine does the work of two conventional machines.
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'Darvic' is the registered trade mark for the rigid p.v.c. sheet made by I.C.I.



IMPERIAL CHEMICAL INDUSTRIES LIMITED · LONDON · S.W.1.

MODERN REFRIGERATION October 1959

PD.69

831



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this means **easier fitting**

Insulation is packed in under 'gentle compression'. Loose infill expands to fill irregular cavities.

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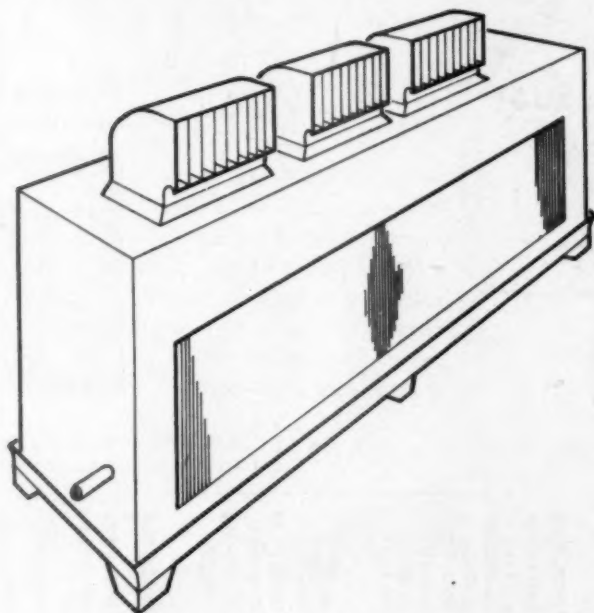
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STANDARD RW MODELS FOR TEMPERATURES DOWN TO -25° F WITH WATER DEFROSTING SYSTEMS. DUTIES RANGING FROM 18,000 TO 180,000 BTU's/HR AT 10° F T.D.

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FROST HEAVE EQUIPMENT**

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which are widely used in
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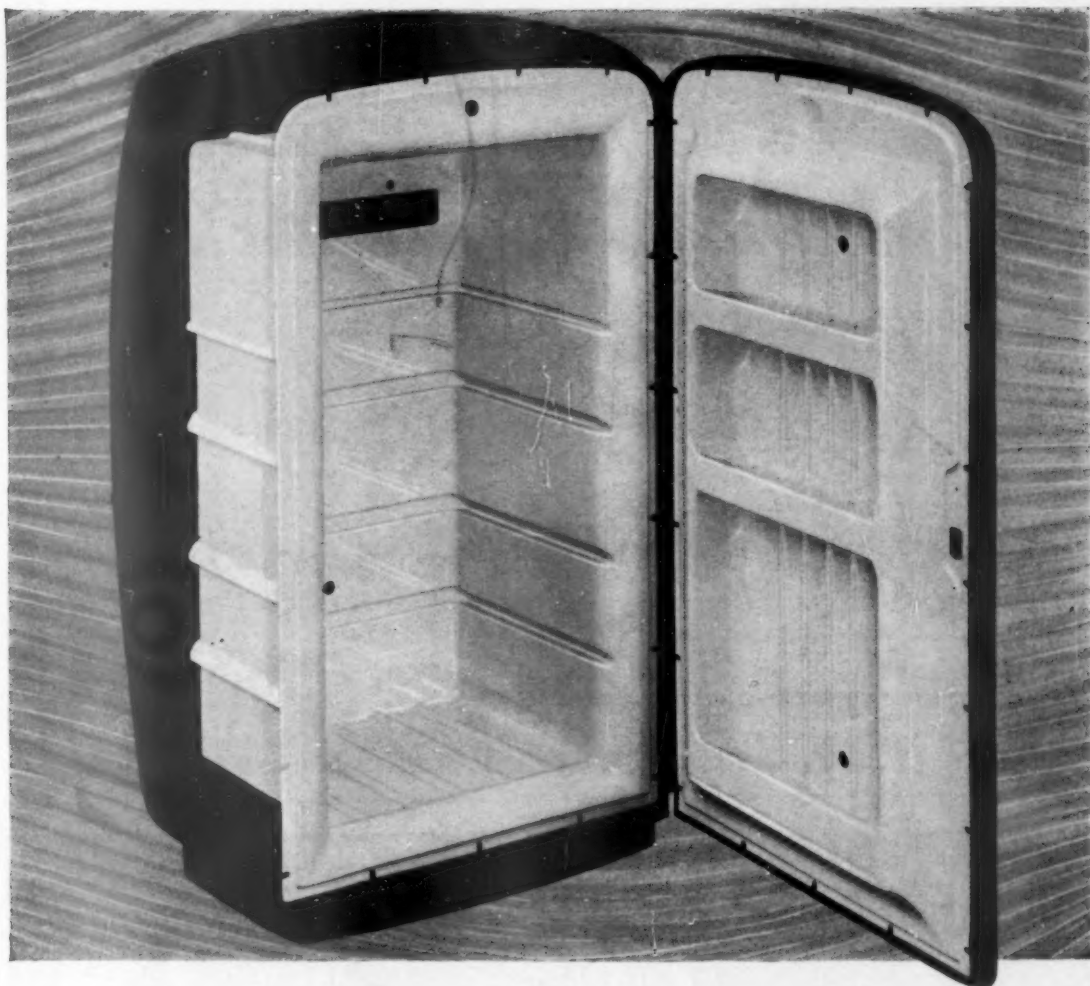
VISCO
Air Filters



FWS

834

MODERN REFRIGERATION October 1959



Streamlined linings

This complete inner and the door lining for the Astral refrigerator are vacuum-formed, in Bextrene toughened polystyrene sheet.

Refrigerator inner and
door lining by
Thermoplastics Ltd
Dunstable

This is extruded from granules of BEXTRENE BC15 high impact polystyrene — more than four times as tough as general purpose polystyrene. It is ideally suited for thermo-forming either by draw-forming or vacuum-forming or by a combination of these processes. Owing to the high yield, Bextrene Sheet is a most economical material to use. Its specific gravity is approximately 1.06

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WHICH IS WATERTIGHT**

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Incorporating all the existing advantages of the well-known "Pop" Rivet, the "Imex" Rivet offers tremendous new advantages in assemblies where a gas- or water-tight joint is essential.

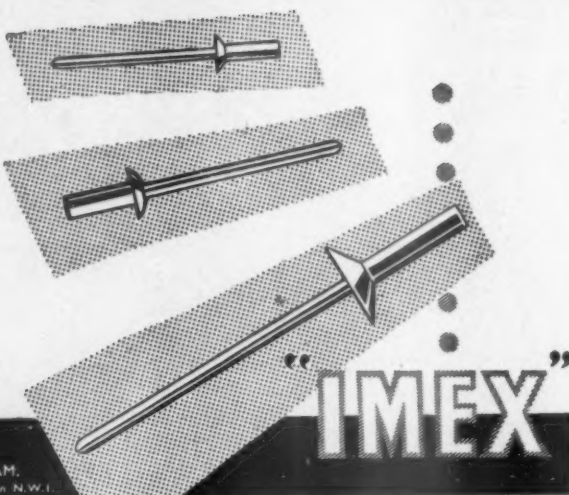
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We have also a technical
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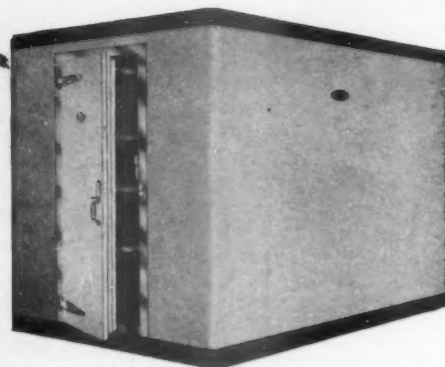
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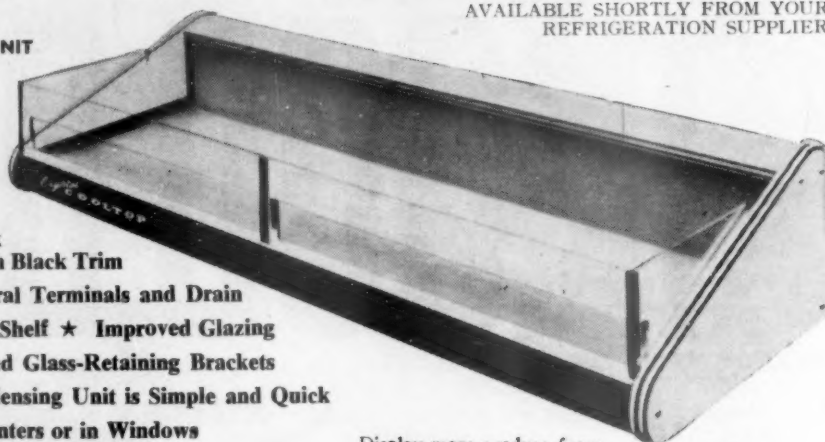


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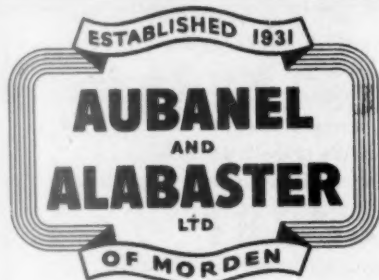
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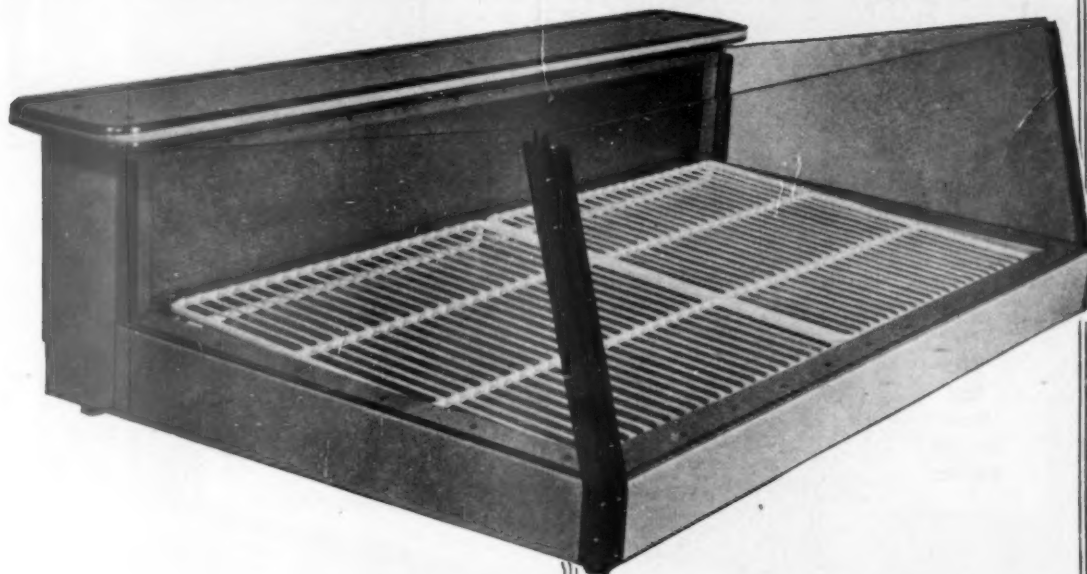
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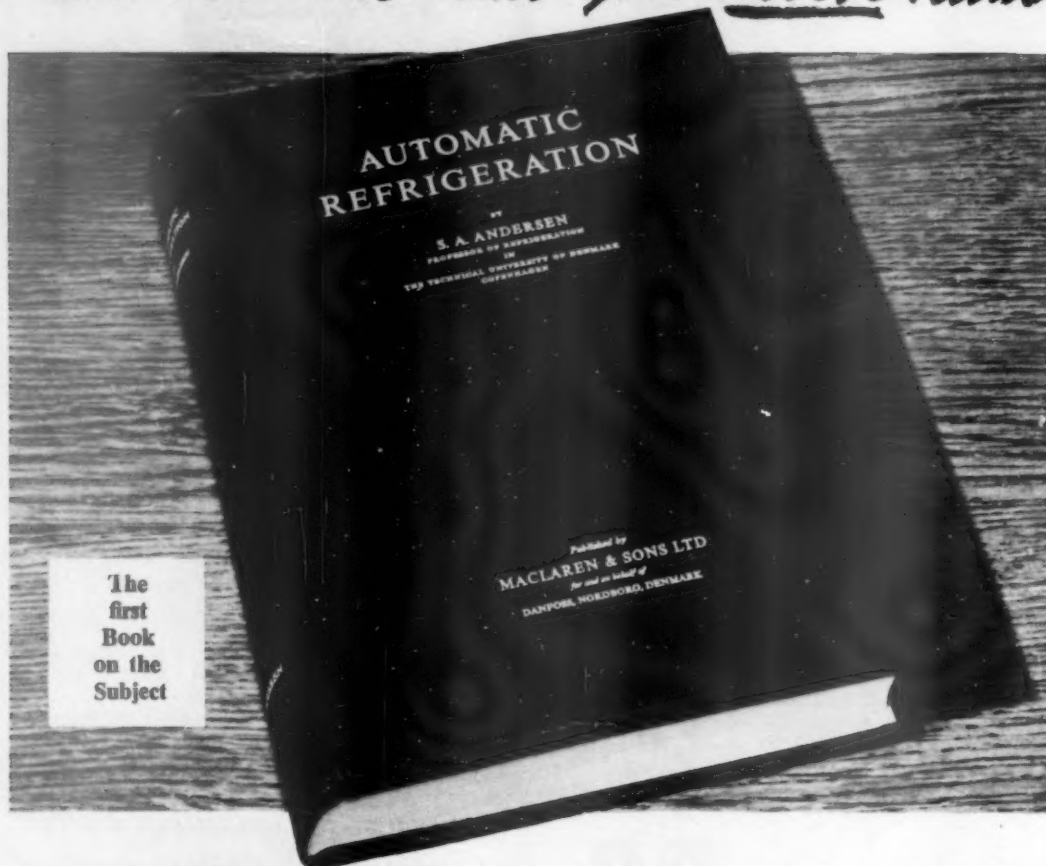
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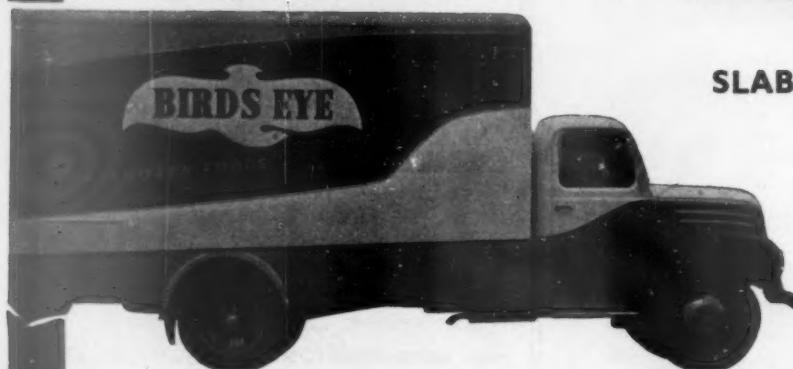
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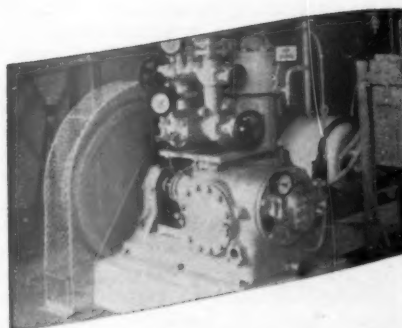
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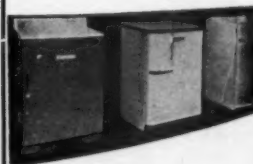
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VOLUME 62

NUMBER 739

October, 1959

Editorial

Developments in Food Marketing

Frozen Foods from "Slots"?

British Diesels in the U.S.

● An interesting and novel approach to food marketing in this country is being made by the Marks and Spencer organization who have lately taken up the sale once more, after a break of nearly twenty years, of provisions. Refrigerated services have now been called into action. M. and S.'s system involves the daily marketing of fresh produce which is sold from chilled counters. In other words, home-grown produce—three varieties of sausages, five of pies, five of bacon, one of ham, one of chicken and five of cheese—is shipped each morning from neighbouring areas to those branches equipped with refrigeration and is displayed at 38 to 42° F., with understock kept in the bottom, enclosed part of the cabinet at the same temperature. Any goods not sold by closing time are not again offered for sale.

● When talking to "M.R.'s" representative an M. and S. spokesman made it clear that three salient features dominated their approach to provisions: 1. All goods must be cleared each day—there must be no carry-over. 2. Only English produce must be sold. 3. Everything must be prepackaged—not only to preserve the life of the goods but for the sake of hygiene. This provisions programme was launched on February 27 this year and so far the department has been introduced at Wolverhampton, Leicester, Liverpool, Preston, Birmingham, Leeds, Bradford and Luton. A new West-end store with a provisions department—the first in London—will be opened on October 30, in Edgware Road, London. A further five stores will introduce provisions at the end of 1959, while up to 50 branches may have refrigeration by the end of 1960.

● The refrigerated display cases have been made specially to M. and S.'s design and they are 8 ft. in length, having one condensing unit per cabinet placed alongside—making them, in fact, 10 ft. overall. These cases are castor-mounted so that adequate cleaning at the rear is possible. All the equipment installed thus far has been by Frigidaire.

● The largest press conference on frozen foods ever held in this country was staged at Grosvenor House last month when Birds Eye announced

substantial price reductions in frozen peas and their chairman surveyed the whole field of retail selling. Your representative posed the question to Mr. Parratt that since the company was now producing a 5-oz. pack of peas for the round sum of one shilling, did Birds Eye envisage selling frozen foods from vending machines? The chairman replied that, if a suitable and reliable low temperature vending machine could be produced, his company would certainly seriously consider its adoption. The design and manufacture of such a piece of equipment, should not, in our opinion, be outside the capabilities of our industry.

● A heart-warming export story is the recent success of a British diesel engine—the 1.6 litre Perkins Four 99—which has pioneered the dieselization of frozen food transport in the United States. The Transicold Corporation, of Los Angeles, now the second largest—and rapidly growing—manufacturer of this type of refrigeration equipment in the United States, ordered "Four 99" engines for trial testing in reefer refrigeration units mounted beneath refrigerated vans in 1958. These proved so successful that 300 have now been installed and another 300 engines are in the course of delivery to Transicold by the Peterborough company. Transicold refrigeration equipment is widely used throughout the United States for refrigerated haulage of both perishable and frozen cargo in large transport trailers, ranging in length from 24 to 40 ft. These travel across the continental United States in temperatures ranging from minus 10 to 80° and units are designed to maintain a constant temperature regardless of whether cooling or heating is necessary, with the engine running constantly as a source of power.

● Transicold which until 1958 designed all its van cooling around petrol or low pressure gas engines, believes that small, lightweight and economical diesels may now oust the petrol engine from this major transport field. Mr. John H. Grim, Transicold's president has stated: "Although we have now 300 Perkins engines on order, we consider this only a beginning. These engines are just the right weight for the job and this is important. Every pound that isn't payload on a truck is lost load and until now diesels were too heavy for our reefer customers to consider" (picture on page 864).

● The giant ice cream factory which T. Wall & Sons (Ice Cream) Ltd., are building at Gloucester is progressing well on schedule, thanks in part to the wonderful summer. Among the first of the structures completed is a new depot, officially opened on the 1st instant. The depot replaces an old one at Cheltenham and it will serve a population of 365,000 in an area stretching from the Forest of Dean to Stow-on-the-Wold and from Tewkesbury to Stroud. The depot incorporates all the latest improvements, such as a powered conveyor in the cold store. Its floor area is 8,140 sq.ft. and its cold store can hold

as many as 600,000 portions of ice cream. Hardly a month passes now without some evidence appearing in these columns supporting our advocacy of the mechanization of cold stores, a policy that we have been preaching since before the war.

● The 1959 edition of *The British Refrigeration Handbook*, now published after being unavoidably delayed in its production, is the ninth in the series to cover the home industry. While retaining its familiar style, the format has been changed somewhat to provide an even readier reference guide. We say, with considerable smugness, that this volume is a

"must" for the busy executive's desk and also for other vital points in the office, works and salesroom! Orders should be sent to The Book Department, 131 Great Suffolk Street, London, S.E.1.

● It is good news that the expansion of Britain's trade with Scandinavia is to be encouraged by Hambros Bank. Hambros will negotiate and arrange the necessary credit finance to assist transactions, and generally accept the insurance risks. Traditionally one of Britain's steady export markets, this area has received a declining quantity of refrigeration plant in recent years.

FURTHER EXPANSION AT HILLINGTON

In August we published some illustrations of L. Sterne and Company's hermetic unit division at Hillington, but referred only briefly to the tremendous expansion that has taken place there in the last few years and is still continuing.

It can be fairly said that factors contributing to the outstanding success of this organization, which is headed by Mr. David S. Carruthers, are four fold: high productivity; consistently maintained high quality; maintenance of promised delivery schedules and giving the customer the maximum after-sales service.

As licencees for Tecumseh equipment, L. Sterne and Co. Ltd. are now producing some 2,000 units daily. Plans in hand for expansion of the factory

space will add 60,000 sq. ft. to the existing capacity. This will eventually allow production of 6,000 units per day in the company's hermetic unit division.

The bulk of the output goes to export, and it is satisfactory to know that a large section of this is dollar-earning.

For the years 1955 to date the percentage of exports has been between a high of 74% and a low of 64%.

Developments at Hillington will include the production of a two-pole, high-speed "T" compressor in sizes $\frac{1}{2}$ h.p. to $\frac{3}{4}$ h.p. and additional tooling capacity for the "pancake" line will be installed by the end of this year. Another two-pole machine, smaller than the "T," dome shaped and measuring only $6\frac{1}{2}$ in. by $6\frac{1}{2}$ in. will be introduced later. An in-line "twin" compressor, in a range from 2 h.p. to 10 h.p., is promised in the not-too-distant future.

German Jubilee Conference

THE German Refrigeration Association (DKV) are holding their 50-year jubilee conference in Berlin from October 15 to 17, 1959.

Professor Plank will give the opening address on the "History of the German Refrigeration Association," and the programme for sessional meetings will be:

Prof. T. E. Schmidt, Mannheim:

Development of refrigerator machine construction in the past 50 years.

Dr. W. Haenlein, Nuernberg:

The technological problems in the application of the Peltier Effect.

Dipl. Ing. H. G. Hirschberg, Karlsruhe:

Heat exchange and pressure loss in tubular apparatus.

Dipl. Ing. H. Keinath, Berlin:

Ammonia turbo-compressors for large refrigerating installations.

Prof. J. Kuprianoff, Karlsruhe:

Fifty years of application of refrigeration to the field of food preservation and manufacture.

Dipl. Ing. E. Sprenger, Berlin:

Air-conditioning yesterday, today and tomorrow.

Dr. Ing. R. Hilpert, Leverkusen:

Refrigeration in the chemical industry.

Prof. H. Hausen, Hanover:

The scientific basis of refrigeration in the last 50 years.

Prof. P. Grassman, Zurich:

Production of strong magnetic fields with deep temperatures and supraconductivity.

Prof. E. Justi, Brunswick:

Physical basis and progress in materials technique of Peltier cooling.

Drs. Ing. H. J. Löffler and A. Thelen, Karlsruhe:

Lubrication of cylindrical surfaces with oil-refrigerant mixtures.

Visits have been organized to the Grain Research Institute, and to the works of Borsig A. G. and Siemens Elektro-geräte A. G.; also two circular tours to places of interest.

NEWS OF THE MONTH

Refrigeration and A-c. Exports.—During August 1959, air-conditioning and refrigerating machinery (commercial and industrial sizes) to the value of £597,085 weighing 854 tons, was exported from the United Kingdom. Comparable figures for August 1958 were 819 tons, worth £555,403.

* * *

Exports' Analysis.—Of the 854 tons of air-conditioning and refrigerating plant worth £597,085 exported by Great Britain in August—quoted in the preceding paragraph—69 tons went to the Union of South Africa, 145 tons to India, 56 tons to Australia, 22 tons to New Zealand, 32 tons to Canada, 228 tons to "other Commonwealth countries," 44 tons to Eire, 14 tons to Sweden, 57 tons to Western Germany, 21 tons to the Netherlands, 20 tons to Belgium, 9 tons to France, 27 tons to Italy, and 110 tons to "other foreign countries."

* * *

Refrigeration Plant Classified.—Of the total exports of air-conditioning and refrigerating machinery during August, quoted in the first paragraph, commercial refrigerators accounted for 136 tons, worth £80,344, industrial plant and equipment for 165 tons, worth £117,911, refrigerating equipment, including parts of commercial refrigerators, for 293 tons, worth £209,165.

* * *

Exports of Small Refrigerators.—During August, 874 tons of complete refrigerators and domestic refrigeration equipment were sent overseas from Great Britain. These exports were worth £566,244. The 874 tons comprised 71 tons to the Union of South Africa, 24 tons to Rhodesia and Nyasaland, 6 tons to India, 59 tons to New Zealand, 427 tons to "other Commonwealth countries and Irish Republic," 10 tons to Sweden, 10 tons to Western Germany, 6 tons to the Netherlands, 22 tons to Belgium, 8 tons to Italy, and 231 tons to "other foreign countries."

* * *

New Lowestoft Ice Factory.—East Anglian Ice and Cold Storage Co., Ltd., of Lowestoft, have plans for the building of a new factory at Battery Green Road, Lowestoft, close to Waveney Dock.

* * *

Milk Plant Expansion.—The chairman of the Express Dairy Co. Ltd., Mr. W. A. Nell, referred, in his annual report, to the opening of the bottling and processing depot at Wakefield, a depot which had become known in the industry as the "push button dairy," but as new mechanical methods were being continually evolved he would hesitate to

describe it as the last word in mechanization. A new pasteurizing and bottling dairy was being erected at South Ruislip, the bottling depot at Brentford had been re-equipped with high speed fillers and mechanical crating and de-crating devices, and the cheese factory at Appleby in Westmorland costing about £750,000 was almost completed and had started to operate.

CARRIER'S NEW CONNEXIONS IN BRITAIN

An increase in this country's exports and more employment for Lancashire, Clydeside and S.E. London are anticipated as a result of an arrangement made between one of Britain's large industrial groups and a major American industrial corporation. They join together to promote the manufacture in Britain and the sale here and abroad of American-designed air-conditioning and industrial refrigeration plant.

The two parties concerned are STONE-PLATT INDUSTRIES LIMITED, a group with over 60 member companies and export sales running in excess of £20,000,000 a year, and the CARRIER CORPORATION, of Syracuse, N.Y., the world's largest manufacturer of air-conditioning and industrial refrigeration equipment, whose sales last year totalled nearly £100,000,000.

Together they have formed a marketing organization, CARLYLE AIR-CONDITIONING AND REFRIGERATION LIMITED, of 1, King Street, St. James's, London, S.W.1, in which the Carrier Corporation has a controlling interest. Carlyle will market equipment manufactured by certain companies in the £25,000,000 Stone-Platt group under licence from Carrier International Limited, a subsidiary of Carrier Corporation.

This equipment will be identical in basic design and performance to the Corporation's equivalent products in the United States, but detail variations will be made to comply with British Standards Specifications.

One manufacturing company which is principally involved in the arrangement is the Winsor Engineering Company Limited of Glasgow. This company was purchased jointly earlier this year by Stone-Platt and Carrier Corporation; in this case Stone-Platt has the controlling interest.

The Lancashire works of Stone-Platt and a factory at Deptford, London, will also produce the new range of plant.

The above arrangements were announced by Mr. Cloud Wampler, chairman of the board of Carrier Corporation at the Savoy Hotel, London, on the 30th ultimo.

DoRDeC Expands.—The number of domestic refrigerator manufacturers constituting the Domestic Refrigeration Development Committee—DoRDeC—has just been increased to nine by the addition of the electrical division of Radiation Limited. This makes the committee still more representative of the now-flourishing domestic refrigerator industry in this country. DoRDeC was formed early in 1956. The total sales of domestic refrigerators for 1958 were double those of any previous year. In 1959 the sales to the end of July have already outstripped the sales for the whole of 1958.

Giant Air-Conditioned Liners.—Arrangements have been made with Mr. Cornelius Verolme, president of the Verolme United Shipping Yard, Rotterdam, for four 120,000-ton liners to be built as rapidly as possible, announced Mr. L. Edgar Detwiler last month. The liners will be the biggest in the world and each will carry 8,000 passengers, all one class, and a crew of up to 2,000. The cost of each vessel,

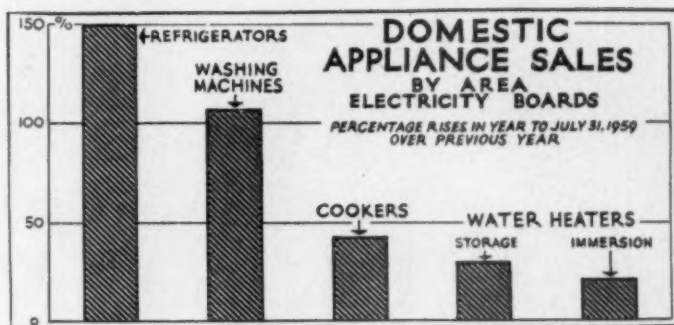


Chart by courtesy of "Financial Times."

fully equipped, including interest repayments, operating capital and a share of the cost of ocean terminal charges, will be about £46 million. Full air-conditioning and self-service-style catering will be features of the vessels.

PICTURE OF THE MONTH

- ★ Aerial photograph shows executive headquarters, research laboratories and Syracuse, New York plants of Carrier Corporation. At lower right is the administration and research centre. In the background are production facilities capable of meeting any air-conditioning or refrigeration requirement from the largest to the smallest. This complex organization contains more than 50 acres of work space under roof. Details of Carrier's new arrangements in the U.K. are to be found opposite.



REFRIGERATION IN AER

THE Farnborough Air Show, which has been staged in that location for a dozen years with such conspicuous success by the Society of British Aircraft Constructors, not only presents many technical editors with one of their most attractive assignments of the year, but also provides a very compact shop-window of the industry. The indoor exhibition keeps one abreast of the fast-moving developments in this field.

Probably because the aircraft industry does not provide a market for quantity production to which the refrigeration industry has become accustomed, the cooling and air-conditioning requirements for Britain's service and civilian aircraft are being met by firms within the aeronautical field.

As reflected at the Farnborough exhibition, Normalair Limited, Sir George Godfrey and Partners Limited, and M. L. Aviation Co. Ltd. supply the bulk of air-conditioning plant for our modern aircraft.

Typical of Normalair's activities in this industry is a 15-ton vapour cycle cooling system designed for aircraft of the new V.C.10 type. The system can be supplied as a pack or as a compact installation for locating in the wing root and/or a forward under-floor fuselage bay. Two such systems—one per side—would normally be required to combat the total heat load of some 36,000 B.t.u. per hour that can be expected with the type of aircraft concerned.

To keep power and weight factors to a minimum, compressed air obtained by jet-tapping is used to drive the condenser fan and the turbine-driven compressor. Turbine speed is regulated by the setting of a control valve that responds to signals from the minimum suction sensor on the downstream side of the evaporator, the datum setting of which is governed by signals from the aircraft temperature control system and an overspeed control on the turbo-compressor. The evaporator fan has a similar regulating valve that responds to a temperature sensing head on the downstream side of the condenser. The coolant air flow is regulated by shutters on the downstream side of the condenser

cooling passages, the action of the shutters being controlled by sensing liquid temperature downstream of the condenser. Surges are prevented by sensing the flow downstream of the compressor by means of a metering head, the signals from which operate a valve in a by-pass line. Depending upon the surge valve setting, some of the gaseous refrigerant circulates round the surge circuit, the circulating gas being cooled by the controlled injection of liquid refrigerant into a mixing box.

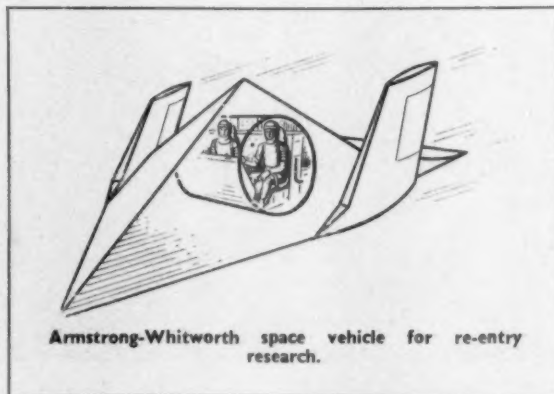
An expansion valve upstream of the evaporator, responding to refrigerant temperature on the downstream side of the evaporator, ensures that the required amount of cooling occurs in the evaporator.

A bursting disc protects the condensers from the effects of excessive pressure, a purge valve provides means of bleeding air from the system, a sight glass provides a visual check on the liquid line for gasification, the drier removes any water that may be present in the refrigerant and the receiver, provided as a storage vessel, may be used as the topping up point for the system.

The Godfrey vapour cycle cooling package VCP-1 Mk. 1 has been designed for cooling airborne equipment. The package incorporates all the components of a complete vapour cycle refrigeration system with the exception of the condenser which is installed in a remote position in the aircraft. Heat generated in the aircraft equipment is given up to a water/glycol coolant circulated through the evaporator of the package; the heat is there transferred from the coolant to the refrigerant and is finally rejected to a cooling flow of ram air through the condenser.

The components of the package are mounted on a light alloy panel fitted with three lugs for fixing to the airframe; the following units form the package:

The compressor set consists of an 8 h.p. a.c. motor coupled to a screw type refrigerant compressor based on Swedish patents. These two components are hermetically sealed in a casing. The outlet of the compressor is connected to the inlet of a vapour oil separator which segregates and returns the lubricant to an oil container and directs the compressed vapour



Armstrong-Whitworth space vehicle for re-entry research.

NAUTICS



Air-Conditioned Handley Page Victor B1 bomber.

through a pipe to the external condenser. Returning to the package from the condenser, the refrigerant is taken into the liquid receiver and after passing through a filter drier, a manual shut off valve and an expansion valve, enters the evaporator; a temperature sensing bulb attached to the evaporator is connected to the expansion valve by a capillary tube.

The evaporator temperature control system consists of a hot vapour by-pass duct from the oil separator to the evaporator. A vapour pressure sensing unit connected to the evaporator outlet operates a valve controlling the flow through the by-pass. A high temperature switch and a high pressure switch operated by sensing elements connected to the vapour oil separator are wired to control the compressor motor.

The following are the main features of the package:

Weight	108 lb. (approx.)
Refrigerant	"Arcton-11"
Load (refrigeration tons)	3.7
Condensing temperature	160° F.

Evaporating temperature $55 \pm 5^\circ \text{F.}$

Evaporator Water/glycol charged

Power supply

motor 200v. 3 phase a.c. 400 c.p.s.

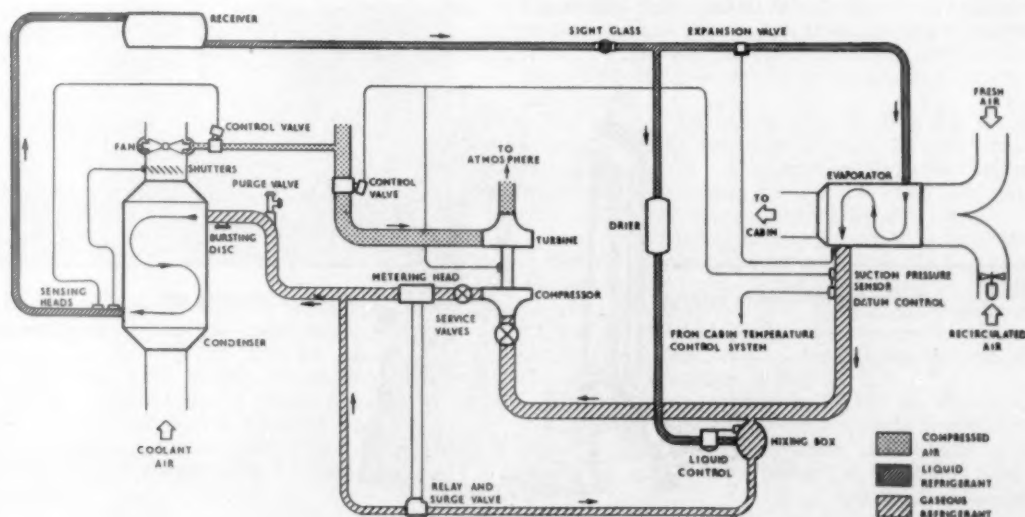
control gear 28v. d.c.

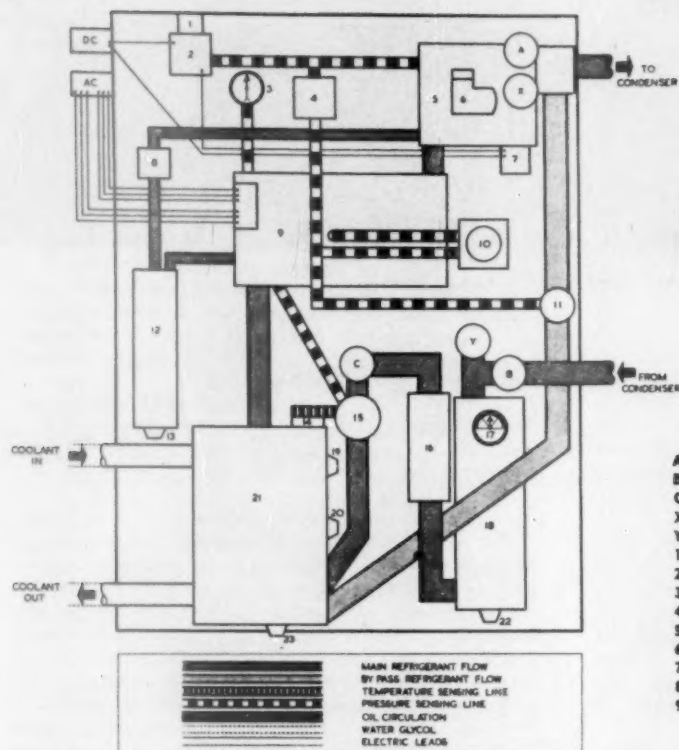
Control System

The correct evaporator temperature and pressure are maintained by the following control system. Upon reduction of the heat load given up in the evaporator, the consequent change in vapour pressure at the evaporator outlet is detected and transmitted through a small pipe to a vapour pressure sensing unit which is then operated to open the jet of a control valve. Thereupon the flow of hot refrigerant vapour is directed through a pipe which by-passes all components between the vapour oil separator and the evaporator, thus resulting in an increase in temperature at the evaporator inlet.

Pressure and temperature sensing connexions from the vapour oil separator each operate a separate

Typical Normalair circuit for 15-ton cooling system.





Godfrey VCP-1 mark 1 vapour cycle cooling package circuit.

- | | |
|---------------------------|---------------------------------|
| A Shut-off valve | 10 Vapour pressure sensing unit |
| B Shut-off valve | 11 Control valve |
| C Shut-off valve | 12 Oil container |
| X Servicing valve | 13 Drain plug |
| Y Servicing valve | 14 Temperature sensing element |
| 1 Time delay switch | 15 Expansion valve |
| 2 High pressure switch | 16 Filter/drier |
| 3 Compound gauge | 17 Liquid level indicator |
| 4 Vapour filter | 18 Liquid receiver |
| 5 Vapour/oil separator | 19 Water/glycol bleed point |
| 6 Oil filler plug | 20 Water/glycol bleed point |
| 7 High temperature switch | 21 Evaporator |
| 8 Oil filter | 22 Drain plug |
| 9 Motor/compressor. | 23 Drain plug |

switch to cut the compressor motor on increase in pressure and/or temperature beyond the design maximum.

Lubricant piped from an oil container through a filter enters the casing of the motor/compressor unit to lubricate the rotor assembly of the electric motor and its bearings. The oil then passes to the compressor to lubricate the bearings and timing gears and thus

enters the compression chamber where it combines with the refrigerant vapour; it is finally discharged through the compressor outlet to the vapour/oil separator whence it is returned to the oil container.

The vapour cycle cooling package is serviced *in situ* by means of a Godfrey servicing trolley VCST-1 Mk. 1 carrying the necessary equipment for servicing the system.

Armstrong Whitworth concept



of rocket launching pad

BOEING COLD TEST CHAMBER

HAVING now been in operation for several months, a new cold chamber has been developed by the Boeing Airplane Company, of Seattle, Wash., U.S.A., which will be used with a universal testing machine for both tensile and fatigue testing of a number of structural materials for missile and space aircraft construction. It has already been used for testing stainless steels, titanium alloys and other alloys and permits such materials to be tested at temperatures as low as -450°F .

In devising such a chamber the problem was not so much achieving the low temperature as containing it. Liquid helium is used to produce the low temperature.

The outer jacket of the cold chamber consists of a stainless-steel shell with an inner lining of urethane plastic foam insulation. Inside this are two vacuum chambers with a liquid nitrogen chamber between them, and a stainless steel test chamber into which the liquid helium is forced. Inside this test chamber is a diffuser, a perforated copper cylinder much like a kitchen colander. The specimen to be tested is placed in the centre of the chamber.

It takes all this insulation to keep the heat out. The liquid nitrogen chamber brings the temperature down to -320°F .

The test specimen is loaded by means of stainless-steel mechanical grips. The bottom grip is stationary and the loading arm running up to it passes through a foam-plastic seal, a stuffing box and an "O" ring seal. A plastic bag covers the top grip, to eliminate atmospheric gases and moisture.

Both the liquid helium and liquid nitrogen are stored in Dewar flasks, which are nothing more than over-sized Thermos bottles. The liquid helium and nitrogen are forced into the test chamber by means of bottled helium and nitrogen gas. Transfer tubes carrying the liquid helium and nitrogen from the Dewar flasks to the test chamber each have an inner and outer wall with a vacuum between for purposes of insulation.

Helium enters the test chamber as a gas with liquid droplets in it, or as a liquid. In the first case, the mixture becomes a vapour in the test chamber when it passes through the copper diffuser. In the second case, the helium remains a liquid.

GIANT FROZEN-FOOD CARRIER

A giant 35-ft.-long 10-ton refrigerated vehicle has gone into service with Smedley's frozen foods fleet. The vehicle is one of two built to the specification of Smedley's technical director, Mr. C. Bell, in conjunction with the Austin Croydon distributors, L. F. Dove (C. V.) Ltd., who specialize in work of this nature. These new vehicles will be used to collect Smedley's frozen foods from the factories and to deliver them to the firm's many refrigerated depots up and down the country.



The 1,100-c.ft.-capacity body by Bonallack & Sons Ltd. is insulated throughout with 5 in. expanded polystyrene and is built on a B.T.C. four-in-line semi-trailer. The York Shipley refrigeration equipment, giving a temperature of minus 5° to zero, is entirely self-contained and is operated on the road by a $1\frac{1}{2}$ h.p. Rustin Hornsby diesel. The tractor unit is the Austin 7 ton chassis with 5.1 litre 105 b.h.p. diesel engine.

Fresh Frozen Milk

A New British Export

Fresh British dairy milk—treated with sound waves and then frozen solid—is to be marketed throughout the world and was to be seen at this month's First National Frozen Foods and Quick-Freezing Exhibition in London.

Sponsored by the National Research Development Corporation, backers of Britain's Hovercraft, the project will enable British farmers to sell any surplus milk in the higher range of manufacturing prices. This could absorb economically any surpluses that might occur as well as giving a higher return to the farmer.

The process will keep milk fresh-frozen for 18 months provided the temperature of the milk itself is kept below 8°F .; this enables it to be shipped anywhere—particularly to tropical countries where fresh milk supplies are not normally available.

Dairy laboratories in many countries have been experimenting to preserve milk for long periods. The new British process is the first to achieve complete success. When this milk is thawed out (unlike the currently available frozen homogenized milk) it returns to a completely natural state without any alteration in condition or taste.

The process was evolved by Dr. W. G. Wearmouth at the National Institute for Research in Dairying, and the invention is now under the control of the N.R.D.C., which holds patents at home and abroad

(Continued on page 860)

A NEW LIQUID EGG STATION



The egg breaking-out room.

PASTEURIZATION AND FREEZING PLANT IN SUFFOLK

THE first fully automatic liquid egg pasteurizing plant to be installed in Great Britain is one of the main features of the new works of John Rannoch Ltd., Haughley Park, near Stowmarket, Suffolk. These works, built at a total cost of £160,000, have been designed for the complete production of frozen liquid egg; until recently, the process in this country has been confined to liquidizing and freezing only, or to the pasteurizing of imported frozen egg.

Pasteurizing has been considered with liquid egg production only since the war when, in 1949, a plant was installed in Ireland. This was soon followed by installations in Poland and, a few years later, two plants began operating in Australia. During the last two or three years official interest has been shown in the adoption of the process, while in one European country an import ban has been imposed on unpasteurized egg. This greatly increased interest in pasteurization is due to the outbreaks of food poisoning and paratyphoid fever which have been traced to Salmonella infection in egg and which have caused so much concern to public health authorities.

The plant at Haughley Park comprises two main installations: the egg-breaking and pasteurizing

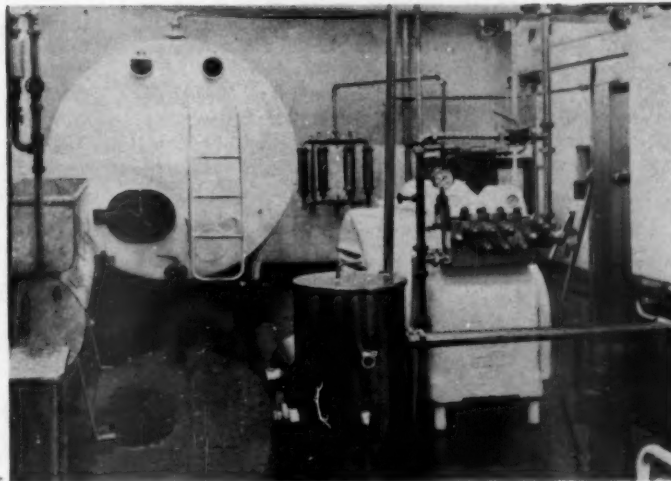
section, and the freezing plant and cold stores. York Shipley Ltd., of London supplied the refrigeration plant while the A.P.V. Co., Ltd., of Crawley, Sussex, were responsible for the processing plant.

Eggs supplied daily are broken by hand and checked for imperfections. The liquid is tipped into a 60-gallon receiving tank and pumped through a double sided filter unit fitted with a change-over cock. This removes particles of shell and chalazae and being a duplex unit the filter can be operated continuously, one side being cleaned while the other is in operation.

When breaking at the required rate the egg can be passed directly to the feed balance tank of the pasteurizing plant following filtration, but as normally the breaking rate will be either above or below the pasteurizing rate an intermediate insulated storage tank of 1,000 gallons capacity has been installed. A small A.P.V. Type H.T.A. Paraflo chiller is also incorporated in the line immediately before the filter which will be used only if breaking out at a very low rate, or if egg is to be stored in bulk overnight.

From the small float balance tank which is fed by gravity from the storage tank or direct from the filter, the egg is pumped by means of a stainless steel

Part of the A.P.V. processing plant including storage tank, filters, homogenizers and sterilizing tank.



centrifugal pump to the K6-5B.S. APV Manton-Gaulin homogenizer. The homogenizer itself, being a positive pump, could draw egg from the float balance tank but there would be a risk of drawing air also, which would promote burning in the plate heat exchanger. In addition, the centrifugal pump is extremely useful during start-up, and for in-place cleaning where the homogenizer is by-passed.

The purpose of the homogenizer is to emulsify thoroughly the yolk and white fractions which enables slightly higher temperatures to be used in the pasteurizing process. The homogenizer also acts as a positive pump and ensures that egg is fed to the Paraflow at a constant rate, which is essential if correct pasteurization is to be guaranteed.

From the homogenizer the egg passes to the type HMB Paraflow where it is heated by regeneration and hot water to the required pasteurizing tempera-

ture, following which it is held for 2½ minutes in a series of holding plates in the same machine. It is then rapidly cooled by regeneration, mains water and chilled water to 38° F. and passed to Avery scales fitted with magnetic valves where it is automatically filled into cans for freezing.

First Fully Automatic Plant

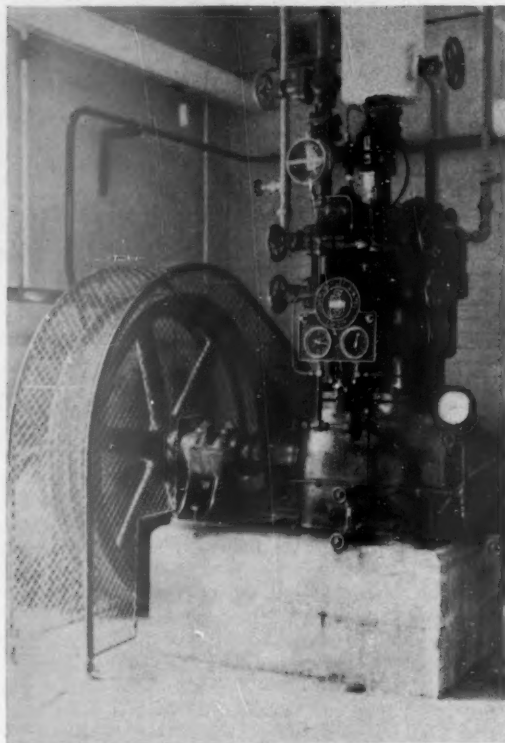
The most important feature of this plant is that it is the first fully automatic h.t.s.t. egg pasteurizing plant to be installed. During the course of a run lasting several hours a film of partially denatured liquid egg tends to build up on the heating section plates and this reduces the heat transfer from the circulating hot water. As a result of this the hot water temperature has to be gradually increased throughout the run. Normally this operation is carried out manually but in this installation there is provided a



Part of the freezing chamber showing the York air blast freezer and cans of liquid egg.

cascade control system which automatically adjusts the hot water temperature to maintain a constant egg temperature.

The plant also incorporates the usual flow diversion valve should the egg temperature fall below the required level at the end of the holding section, and in addition to this an indicating thermostat and



45 h.p. York vertical single-acting ammonia compressor.

pressurestat have been provided, both of these shutting down the steam supply to the hot water set and sounding an alarm if either the hot water or egg temperature exceeds a preset upper limit. These instruments, together with the normal recording thermometers and remote control push buttons are mounted in a special control panel.

Freezing Plant

Liquid egg now sealed in cans is loaded onto pallets in batches of 50 and removed to the freezing chamber by Collis hand lifting platform trucks.

Freezing takes place in a chamber 33 ft. long, 14 ft. wide and 8 ft. 6 in. high which is situated between an outer chilling room through which the egg first passes, and a cold store where it awaits collection.

Cooling is effected by air blast units which maintain a freezing room temperature of 10 ° F. Briefly

the refrigeration plant comprises two York 6½ in. bore by 6½ in. stroke twin cylinder ammonia compressors, each driven by a 45 h.p. Brook slipring electric motor; one York forced draught evaporator type condenser, and a high pressure liquid ammonia receiver. The plant is thermostatically controlled for fully automatic operation.

When the egg has reached the required temperature the tins are transferred to the chilled store room from where they are loaded onto a roller conveyer through a hatch built into the insulated wall at lorry floor level. Delivery is made to south-east England and the midlands in the company's own fleet of refrigerated lorries.

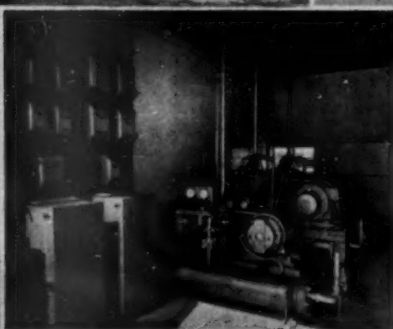
The actual area of the packing station at present under construction is 33,000 sq. ft. but this will be increased later to 56,000 sq. ft. This does not include the offices which will be located in part of the sixteenth-century Haughley Park Mansion. A specially interesting constructional feature is the roof which follows a design entirely new to this country. Termed a "hyperbolic paraboloid" this roof is a simple but ingenious method of covering large areas of space; its chief advantage is that it is made from simple straight members and requires no complicated trusses, beams or curved members. It is constructed of a series of self-supporting shells, square in plan and formed by the laying of three thicknesses of ½ in. boarding, which is twisted along its length. This twisting forms the shape of each roof, which is basically two high points at opposite diagonal corners, and low points at the other two corners. The low points are tied down by a diagonal high tensile steel bar running between them, this being the only obstruction below the underside of the roof. The edges of the roof are strengthened by timber edge beams and appear as inclined straight lines between low and high points. The roof is covered with insulation board and silver-coloured waterproofing.

The roof was designed by Wheelers of Sudbury in conjunction with the Timber Development Association. Architects for the scheme were Johns, Slater and Haward of Ipswich, while the builders were Blackburns Ltd., Harleston, Norfolk, a subsidiary Company of R. G. Carter Ltd., Norwich.

Dairy Ice Cream Campaign.—Members of the Wholesale Ice Cream Federation have co-operated together with the Butter Information Council and the Milk Marketing Board in an intensive press campaign, which began in July, to promote the sales of dairy ice cream. Over the past three months large advertisements appeared in the national press. The new campaign emphasized the dairy ingredients, as, under the regulations which came into force in September, only ice cream made with butter, or cream and butter may be described as "dairy ice cream."



Handling of Turkeys in Norfolk



l. to r., top: Mr. Roy Benton with a fine example of his stock; the new freezer building; inside the cold store.

l. to r., bottom: entrance to freezer and store; the refrigeration plant and control panel.

FREEZING OF BIRDS

eases pre-Christmas peak activity

WITH two months to go to Christmas, turkey producers who have provided themselves with freezing installations are even now working up to an operational peak, so that the normal December period of frenzied activity will be considerably lessened.

Such is the case of Mr. Roy Benton of Roy Benton (Mundford) Ltd., Norfolk, who estimates that he can process about 50,000 birds a year, but this is by no means the limit of his capacity, now that his turkey freezing installation is complete.

From his farm in Mundford, near Thetford, frozen prepacked turkeys go out to wholesalers all over the country, some as far as Scotland, and Mr. Benton, in co-operation with wholesalers, is just starting a scheme to distribute similarly packed and frozen quarter-turkeys through the frozen food retail trade which will it is hoped popularize this bird for consumption throughout the year. The sale of quarter-turkeys is already accepted in America and

will undoubtedly develop in this country. He is concentrating on the extreme broad-breasted variety and there is no doubt that these turkeys are magnificent birds. Specially bred and reared by Mr. Benton, they average 15 lb. when ready for the table.

Eggs from the breeding turkeys, kept in mobile fold units on the 220 acre farm in Mundford, are transported to Mr. Benton's second farm at Stalham where 110 acres are devoted to their incubation and rearing. This dissociation is the result of a lesson learnt a year or so ago when Mr. Benton's turkeys were heavily affected by fowl pest. Between 15 and 26 weeks old, at the optimum weight and size, the birds are killed, plucked on a wet plucker and eviscerated. They are then immersed in ice-cooled water to remove the initial body heat and drained, swabbed, packed and vacuum sealed in Cry-o-vac bags. Immersion in hot water shrinks the Cry-o-vac onto the skin, eliminating air pockets which could insulate the turkey's surface when being frozen.

After weighing they are taken to the blast-freezer room and quick-frozen. This room normally deals with about 150 turkeys every four hours (although it has the capacity to deal with 300 should this be required). Now Mrs. Roy Benton takes over for grading and packing and dispatching comes under her jurisdiction. Each bird is individually packed with vegetable parchment shavings in an attractive white cardboard box, printed in red and blue. Some are dispatched straight away in insulated vehicles (under contract to Mr. Benton), those not required immediately are stored in the 7,000 c.ft. refrigerated holding room.

The refrigeration installation which is automatic in operation was designed and carried out to Mr. Benton's instructions by Refrigeration (East Anglia) Ltd., the Prestcold distributors, on a site which was originally a Dutch barn, housing farm machinery. The existing earth floor was excavated to a depth of 3 ft. and a concrete raft laid down incorporating a hollow block structure for under-floor ventilation by natural air circulation. The holding room and adjoining blast-freezer room are housed in one building with a separate section for the three condensing units, motors and control panel at the rear.

The holding room which, to meet the requirements of Mr. Benton, has no internal obstructions, is refrigerated, by four unit coolers with electric defrosting controlled by a time switch. The coolers are operated by a Prestcold 10 h.p. water-cooled condensing unit, controlled by the room thermostat. The internal finish of both rooms is in "Granitone" which provides a hard-wearing surface as well as a suitable background showing the attractive appearance of the packed turkeys. The outside is finished in resin-bound plywood with a high-gloss enamel giving a "wipe-down" surface. Galvanized "kicking" panels are fitted at the bottom of the sides and doors. The super freeze doors and loading hatches incorporate heater gaskets and easy release handles.

The 825 c.ft. blast-freezer room, which has a capacity for 300 turkeys, has two evaporators which consist of two special extended fin coils with electric defrost heaters and these are operated by two Prestcold 20 h.p. water-cooled condensing units. Two 30 in. fans provide air velocity. Entering the blast-freezer, the processed and Cry-o-vac-wrapped turkeys are placed in trolleys which, when in position, complete the system of air guides so that the turkeys are subjected to a very high velocity air blast at a temperature of -15° to -20° F.

When the plant is switched on the freezing operation is entirely automatic, controlled by a thermostat, with timers and relays being brought in for sequence-starting since only a limited amount of electric power is available. Further to reduce current consumption the electrical defrost period is split in two by time controls.

To economize in the consumption of water by the condensing units, a recirculated-water tower of 1,700 gallons per hour capacity is used and this incorporates a

thermostatically controlled heater to prevent freezing should the ambient temperature fall below 32° F. during the winter.

The degree of automatic operation required necessitated an ingenious arrangement of a wide range of electrical equipment and a steel sheet panel was constructed on which starter, switches and ancillary controls were mounted, all electrical wiring being carried out in conduit and troughing, with the wiring on the reverse side to preserve an attractive appearance.

FROZEN MILK

(Continued from page 855)

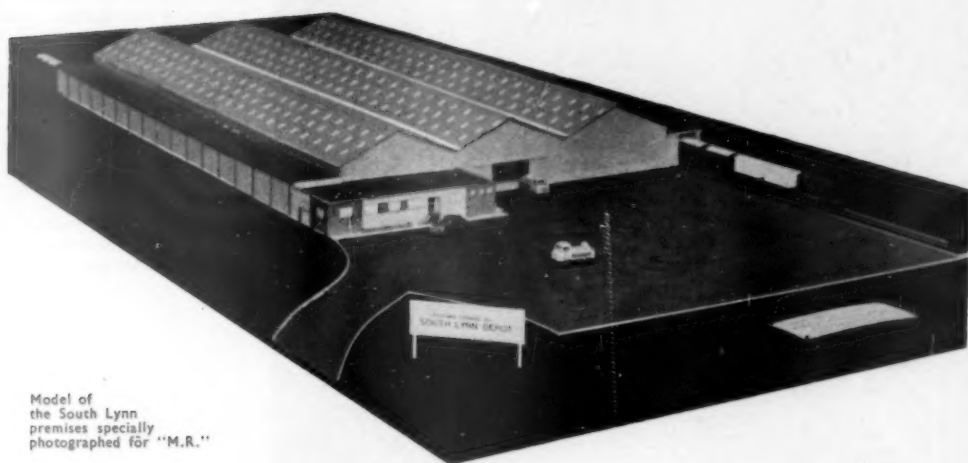
covering the technique. A major British ice-cream manufacturing company has been granted a licence to produce the frozen milk which is already being made in small quantities. Full-scale production will start later this year.

The process, after normal pasteurization, consists in treating the milk with ultrasonic vibrations of about a million cycles per second for five minutes, and pouring it into containers for quick-freezing. The process is continuous and there is no delay between the different operations. The milk can be transported in containers of up to one gallon capacity in refrigerated ships, trains or lorries and is also sold in liquid-proof cartons down to half-pint size.

Mr. P. T. Plunkett, who farms in Cornwall, has been investigating, on behalf of the N.R.D.C., the market potential of frozen milk and has recently returned from a six weeks' tour of the Middle East. He visited Kuwait, Bahrain, Beirut and Qatar and during his tour trial shipments of about 700 pints of the milk were distributed to both British and foreign communities in those areas. Reactions from oil company personnel, merchants, schools and the local populations were encouraging, and with a considerable demand from these communities, exports to the Persian Gulf are expected to begin in the early autumn. A shipment sent to British service personnel in Aden also created a favourable impression. With the expansion of cold storage in the Middle East, fresh-frozen English milk should in time replace existing supplies of the various canned substitutes for fresh milk which are now in use.

Government medical authorities in the Middle East have tested samples from the trial shipments and found them indistinguishable from fresh pasteurized milk.

Mr. Plunkett also had talks with F.A.O. officials in Rome who were interested in the possibility of distributing surplus milk in frozen form to children in refugee camps or underdeveloped countries. The services, oil companies and shipping lines are all investigating the possibility of taking supplies. One shipping line already uses it—enough frozen milk for a return trip to Australia can be loaded in the vessel's refrigerators before setting sail. Usually, passengers have had to drink tinned milk after a few days at sea.



Model of the South Lynn premises specially photographed for "M.R."

LARGE COLD STORES OPENED IN NORFOLK

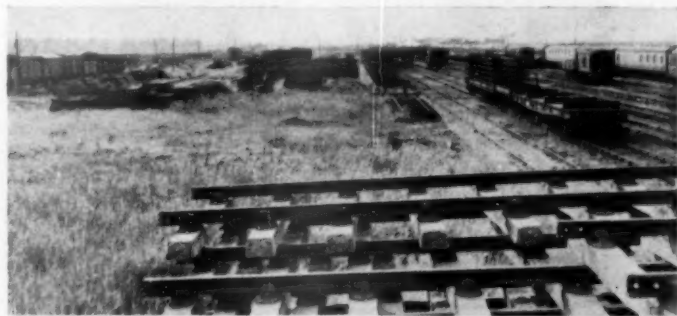
IN this largely agricultural county, home-grown produce is normally dispatched beyond its confines without delay after harvesting. Thus, we find that Norfolk does not abound in public cold storage premises (as distinct from the privately-owned stores maintained by frozen food processors). A new building which "M.R." visited last month will be a valuable addition to the county's refrigerated capacity.

At the former South Lynn Station, near King's Lynn, a new dry foods and refrigerated storage depot has been set up, the first stage of which is nearing completion. This enterprise is the South

Lynn project of Pointer Storage Ltd., an undertaking in the Harry Pointer (Norwich) Ltd. group.

This project, which will provide much needed storage space for dry and frozen goods from home and overseas sources, has broken many constructional records. Built of necessity on piles of over 45 ft. in length the entire first phase of the project, from original plan to completion, will have taken less than 10 weeks to complete. In this time a disused railway station and marshalling yard will have been radically reconstructed and a new storage depot of some 400,000 c.ft. has been erected.

The South Lynn building consists of three bays,



The scene that faced the contractors—

the marshalling yard at South Lynn —

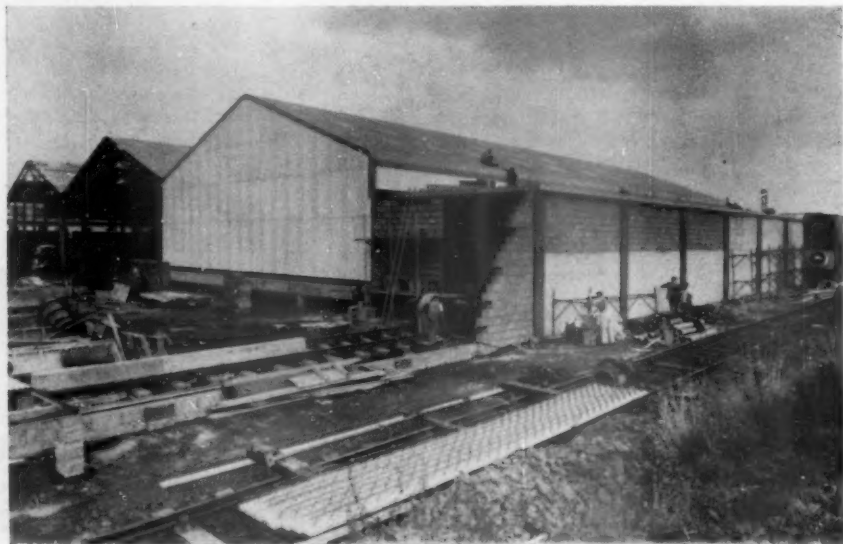


Weekly site meetings such as this held in converted rail coaches became a feature of the project. Left to right on left of table are Mr. J. Manson of Frankipile Ltd., Messrs. Z. Myers, N. Williams and J. Mathews of the Pointer Group and Messrs. G. F. Leech and H. Balders of Mann Egerton & Co. Ltd. Left to right on right of table is the minute secretary hiding behind Mr. S. Roberts of Coseley Buildings Ltd., who is partly hidden behind the chairman, Mr. Peter Pointer, who has next to him Messrs. A. R. Mackay and C. T. R. Bulmer from the consulting engineers, Frederick Snow and Partners.

each 60 ft. wide. The framework is of the Coseley standard pattern, which is particularly suitable in a storage building as the tapered verticals and clear headroom provide the maximum space. The building is 20 ft. high to eaves though it appears to be slightly lower internally owing to a raised floor. Externally the building has the curved eaves and ridge which are "hallmarks" of a Coseley building, and the sheeting is in asbestos cement. The roof is in Westmorland Green, while cream panel sheets are used on the front gable and round the sides to meet the concrete roof of the brick structure.

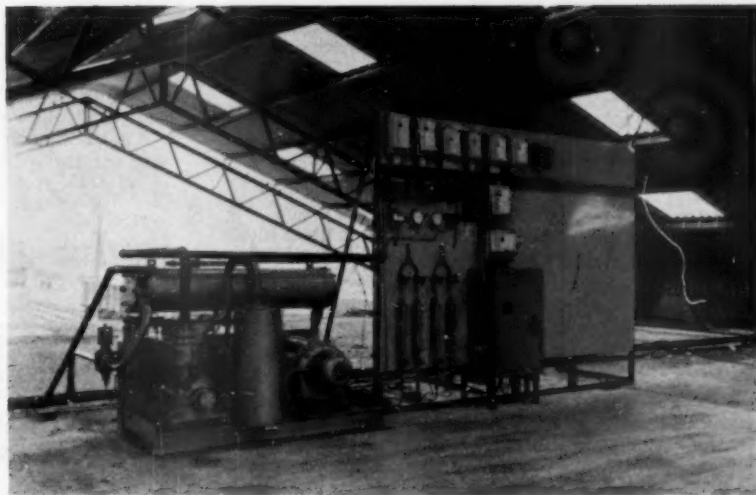
Verticals to the Coseley portal frames are galvanized. In the cold store section they are placed at 25 ft. centres to accommodate the refrigeration plant, as against 12 ft. 6 in. and 15 ft. centres in other parts of the building. This involves the use of a heavier frame in the cold storage section, but such a frame is included in the Coseley range to meet this need and others including the heavy snow loading in certain overseas areas.

The sliding doors to the building have been specially made by Coseley to pass over the railway lines which are housed in the brick extensions at either side.



Nearly completion of the first stage.

The first of eight 15 h.p. "Sternette" condensing units providing the refrigeration for one of the storage chambers.



In their contribution to the project Coseley Buildings Ltd. of Wolverhampton faced a stiffer task than is implied even in the tough overall schedule. Although some two months were allowed for the transformation of the site from a disused railway siding into a modern dry store and cold store, the effective working time available to Coseley was only approximately 30 working days. Their task was to supply and erect the main steel-framed and sheeted part of the structure, measuring 180 ft. wide by 140 ft. long.

For Frankipile Ltd. the opening on September 24 of the new cold store and warehouse by the Mayor of King's Lynn marked the final stage of a piling job begun at very short notice and carried out with exceptional speed. The opening ceremony took place within 10 weeks of an inquiry telephoned on the morning of Friday, July 17, to the Frankipile head office in London. It came from Messrs. F. S. Snow & Partners of Norwich, the well-known firm of consulting engineers whose recent work includes Gatwick Airport. For the South Lynn project they required about 160 piles, each 45 ft. long and able to bear a load of 40 tons. A start had to be made to install these on the following Wednesday.

Stage I of the project, as far as the refrigeration and cold stores are concerned, consists of eight rooms each approximately 13,000 c.ft. capacity making a total storage of over 100,000 c.ft., and within this space it is possible to store almost 1,000 tons of produce. The refrigeration and insulation contract was handled by Mann Egerton & Co. Ltd. of Norwich.

The eight rooms are insulated with expanded polystyrene of sufficient thickness to enable a temperature of -10°F . to be maintained but at present six of these rooms are being maintained at that temperature with the remaining two rooms operating on one condensing unit and maintaining a temperature of 32°F .

The equipment used includes eight of Sterne's 15 h.p. water cooled condensing units, six of these units operating independent rooms, each room having two Searle-Bush forced convection coolers; the eighth unit is a spare unit but is connected into the circuit in such a way that it can be brought into operation at any time.

A feature of this installation is the care that has been taken to duplicate equipment to avoid loss of refrigeration should a breakdown occur. The spare refrigeration unit will be permanently connected into the system so that should any one of the other units become faulty with a defect on any component, a spare unit can be brought into the particular circuit by the operation of control valves while the faulty unit is being repaired.

As a further safety precaution all components such as expansion valves, dehydrators, line strainers, sight glasses, thermostats (by Ranco), etc. are duplicated so that should any one component break down, the faulty components can be isolated by means of line valves bringing fresh components into use without the necessity of removing the faulty components as it may not be always convenient to carry out such a repair due to the loading of the cold-room.

An audible alarm has been fitted which can be operated from inside any cold-room should any difficulty arise whilst the operator is inside the store and unable to open the door from the inside by normal means. This alarm is connected to an indicator panel which will show a visible light in addition to giving an audible signal and will indicate from which store the alarm is being made.

"M.R." understands that Refrigerator Components Ltd. of London supplied the components and that they met the very "tight" delivery dates in all instances.

Recording thermometers are fitted to each cold-room showing on a seven-day recording chart the actual

storage temperature of the products inside the room, and in addition indicating thermometers fitted above the cold-rooms show the temperature of the ground beneath the cold-store to ensure that no danger is present through a build up of frost beneath the cold-room.

The latest type of Miniveil air curtain is fitted to each door to minimize the air change during loading and off-loading of the cold-rooms, and these air curtains dispose of the necessity for an air-lock, thereby saving considerable valuable space in addition to preventing the spillage of cold air from the cold-room.

The water for cooling the condensing units is recirculated through a water reclamation tower as 4,000 gallons per hour of water are necessary for this purpose, and by means of this tower, 97 per cent. of the water used can be saved. This water is pumped to the condensing units by centrifugal pumps, these pumps again being duplicated and valved so that if one pump proved faulty for any reason, the second pump could take care of the complete condensing system.

Some 2,200 cartons of polystyrene, occupying approximately 13,200 c.ft., were delivered to site in 20 railway trucks, and 20 tons of bitumastic were used in the installation of the insulation in addition to several tons of vapour sealing for the exterior of the insulation and walls.

In addition to the eight 15 h.p. motors, 32 motors are provided for operating the fans on the forced convection coolers, eight motors are provided for operating the fans on the Miniveil air curtains, and a 4 h.p. motor is provided to operate the fan for the water cooling tower and two 2 h.p. motors for the centrifugal water pumps for the same tower. When completed the system will hold approximately 1,500 lb. of refrigerant.

When the premises have been completed, the cold store will total 300,000 c.ft.

BOOK REVIEW

Mechanical Refrigeration. By Norman R. Sparks and Charles C. Dillio. x+283 pp. incl. 97 figs. and 54 pp. tables, and 8 charts in rear envelope 9 in. x 6 in. 2nd Ed. 1959. McGraw Hill.

This is the second edition of a book originally published in 1938. The authors are professors at the Pennsylvania State University and the book is prepared for the student, with an opening chapter on basic thermodynamics. It provides a wide coverage of the many possible systems including the basic theory of centrifugal compressors, multi-stage compression; air refrigeration including its application to aircraft; absorption refrigeration; steam jet refrigeration; solid CO₂ systems and multiple evaporators; the refrigeration aspects of air-conditioning; and heat pumps.

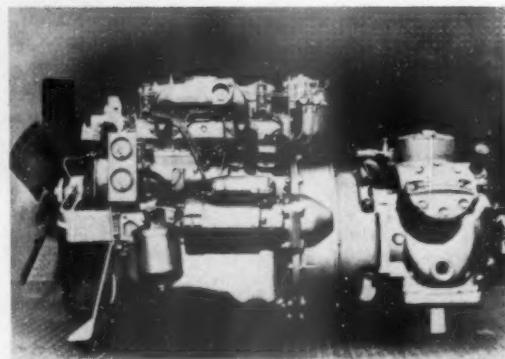
The book is profusely illustrated with line diagrams with a few pictorial illustrations; guidance in the application of theory to practice is given by examples in the text and a series of problems at the ends of most chapters.

This is a most useful book for the specialist and also for the graduate engineer among users.

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BRITISH DIESEL DOLLAR EARNER

(See page 848)



* * *

'All our provisions are refrigerated'

THE Bridgwater branch of International Tea Company's Stores Limited—recently opened by that famous radio character Mrs. Dan Archer—is based on modern self-service lines. And naturally in such a modern establishment refrigeration plays an important part, and prominently overhead an illuminated sign proudly proclaims "all our provisions are refrigerated." Immediately apparent to the customer is the Prestcold Farmoor frozen food case and in the meat department—also clearly designated by an illuminated sign—is a 22-ft.-wide-version Prestcold Parade case, displaying fresh, pre-packed meat, and operating at a temperature of 28° to 32° F. Not so apparent to the customer, except indirectly in the freshness of the provisions, are the two coldrooms. One of these is a 350 c.ft. capacity room for fresh meat where the temperature is maintained at 28° to 32° F. by a Prestcold automatically defrosting unit cooler. The other is a 275 c.ft. cold room, operating at 6° to 10° above freezing point, for the storage of dairy produce. This room has a unit cooler and, of course, no defrosting is needed at this temperature. The refrigeration equipment was installed by Gardiner Sons and Company Limited, Prestcold distributors in Bristol, by arrangement with the London branch of Prestcold. They also supplied seven condensing units and associated equipment for use with cool-top display plates.

THE COPENHAGEN PAPERS

AIR-CONDITIONING

THE SURVEY CONTINUED

By H. MERVYN MEACOCK

COPENHAGEN and its sunshine gave a warm welcome to the congress delegates and kept up the temperature as a constant reminder that air-conditioning might be a comfort sometimes even in Denmark.

It was to Copenhagen that young Hans Andersen came to school from Odense. Some of us remember—or our children or grandchildren have reminded us of his story of "The Ugly Duckling"—of how the nondescript grey "duckling," outcast by his brothers and sisters, eventually grew to be a magnificent white swan who was admired by all.

It seemed to me as I attended the meetings, that air-conditioning was perhaps the ugly duckling of the congress—it had very few papers to its credit and it is fortunate, indeed, that air-conditioning engineers are in the secret that one day their industry will be a beautiful white swan and not the drab little grey thing that appeared at Copenhagen.

Over-enthusiastic members of the industry whose estimating is more generous than accurate were given a salutary warning if they attended the plenary session and heard of the effects of cold on man and operators of their plants should have picked up some useful hints from the description of cold death and reanimation later on in the morning.

Those of us with experience in lithium bromide absorption plants were sorry not to be able to hear a full presentation of their papers by the Russian authors, L. M. Rosenfeld and M. S. Karmanku. The opportunity for discussion did arise at a later session but unfortunately no one was then prepared for it. It would have been interesting to discuss whether the advantage of having water for heating at 100° C. was really a much greater advantage than having it at 60° C. after considering the labour, power and maintenance required to operate their plant. After all, 60° C. is quite a reasonable water temperature for heating purposes and fairly commonly used in radiator systems.

It was a pity too that Mr. W. P. Jones, the author of the paper on "Design patterns for year round air-conditioning" was not present since his paper possessed a certain amount of controversial matter.

The treatment of evaporative cooling in desert areas by M. J. Tirlé was most welcome since some air-conditioning engineers tend to forget or ignore this type of cooling in areas which are admirably suited to its use. His conception of an index of thermal strain is an interesting approach though somewhat subjective in its application.

Mr. Downie Smith's able survey of "Trends in American refrigeration machinery" devoted a satisfactorily large portion to air-conditioning and one felt that here at least was someone who recognized the form of the beautiful white swan. One wondered whether his slanting reference to prolonged telephone conversations had any connection with an attractive teenage daughter who accompanied him.

Figures for the actual improvement in performance due to air-conditioning are hard to come by and those quoted in Mr. Downie Smith's paper are a useful guide.

Professor Jennings made a genuine attempt to produce some order out of chaos in the classification of mechanical systems which helped to clear our thoughts a little. Professor Jennings admitted that wide variations of humidity might pass un-

noticed and I was sorry that he did not move on from there to the conclusion that the safest all-round general indicator of human comfort is wet bulb temperature. During the discussion he became the butt of some rather unfair criticism aimed at American air-conditioning in general.

The Danish team comprising Messrs. Clemmesen, Ibsen and Werner have clearly done a great deal of useful work in their investigations of the figures of the comfort zone. Their programme of work when complete and the results published will be of invaluable service to air-conditioning engineers. One was left with the feeling, however, that rather too pessimistic a picture of the present lack of knowledge had been painted; after all, there are a very large number of well-designed air-conditioning plants keeping people comfortable all over the world.

A great deal of literature exists on the use of computers for calculating heat gains and losses of buildings and the contribution of Burnay and Vidal to this field constitutes an excursion into calculations of radiation which has not before been covered to the same extent as heat transfer in buildings due to air temperature differences.

Unfortunately, it seems a far cry yet to the time when analogue methods will become an everyday tool for estimating loads.

On the manufacturing and design side MM. Burnay and Fafchamps gave some useful pointers to those of us—and there must be many—who have run into inconsistencies in the results of testing air-conditioning units by the method of two calorimeters.

Mr. Ashley's paper on sound control made a useful addition to the already extensive literature on noise and noise control. His plea for the publication of a standard method of testing will be echoed by many. The difficulty of providing rule of thumb methods to sound control are obvious since the analysis is essentially complex—none the less, until some simplified design criteria in a readily applied form are available to application engineers it is not likely that higher standards will become common. An important point which was not dealt with by the author was that of external noise and speech transmitted along air ducts, a problem which needs investigation.

The change of resistance to air flow through a coil, due to condensation is usually calculated in practice by a regression factor applied to the dry coil pressure drops for given conditions. It is often found that such a method can lead to considerable inaccuracies and Herr. Hufschmidt's analysis of the influence of condensation on pressure drop was a most interesting contribution.

Commission VIII provided a section on air-conditioning of accommodation in ships but commission VII unfortunately did not deal with the subject as it applied to rail, road and aircraft. Problems of cooling particularly of personnel in high speed aircraft have formed the subject of several papers and articles in the technical press in the last two or three years and it was particularly disappointing that no contribution was offered in this field.

The use of the cold air cycle for cooling aircraft is now in general use throughout the world and an enormous number of patents have been taken out covering various aspects of the equipment associated with the cycle.

The return to popularity of the old "cold air" machine in its new guise with turbo-compressors and expansion engines is probably among the most important developments in the industry in the last few years and yet there was not one paper on this subject. It is to be hoped that the deficiency will be made good by the time the next congress comes round.

The economics of marine air-conditioning was well covered by M. Norgaard-Nielsen in two papers and it is to be hoped that the charts of world isotherms which accompanied the first paper will be available generally at a later date in a size suitable for general use. Mr. Hickmott's paper served a different purpose and should assist in the evaluation of different systems as they apply to specific cases.

Possibly by the time the next international congress comes round some one will have developed a means of being in more than one place at the same time, at least the Congress should be arranged to take place in a city which does not offer all the temptations to "cut lectures" that Copenhagen did!

The Congress Papers

Thermal Insulation

By A. COOPER, F.R.I.C., F.I.R.I., F.P.I., M.INST.R.

IT is generally agreed that the 10th International Congress of Refrigeration at Copenhagen was the most successful one held so far. It must have been a considerable strain on the administrative, executive and management committees to deal with the larger number attending and those of us who were fortunate enough to be present know how well they discharged their office. Our sincere thanks and congratulations for a job well done is due to our Danish hosts.

From approximately 300 papers, no fewer than 16 covered thermal insulation materials either directly or indirectly, that is to say, as a main or as a subsidiary subject. Limitation of space would not allow all these to be reviewed, nor is this necessary as all participants were given copies of the abstracts and in most cases pre-prints were also available.

The presentation of the papers was, by special request, marked by brevity in most cases, but some found it extremely difficult to assume that the pre-prints had been read and found it even more difficult to comply with a 10-minute rule which was introduced in order to cope with the unexpected number of papers.

Trends

In progressive engineering technology, development never reaches finality and it is interesting therefore to study current trends in the application of thermal insulation materials and, although some of these trends have been observed before, it was again emphasized that a world-wide consciousness exists as to the necessity of continued development of refrigerated, and therefore insulated, transport of perishable produce both by rail and by road, and thus there is an ever-increasing variety of specialized transport vehicles being developed. Many examples were given of how the numbers have increased over the past few years. Some of these have by no means been free from insulation problems—several speakers referred to the high water absorption and water logging through using unsuitable materials. One example of the extension of refrigerated transport jointly with the development of international exchanges of foodstuffs is in the creation of "Interfrigo" for rail transport and "Transfrigoroute" for road transport. Their object is to place at the disposal of customers and all carriers in general, the means and the material, the most adapted for the disposal and the export of different perishable products in the European market.

As far as marine insulation is concerned, the outstanding change in the past four years has been the increase in the application of air-conditioning to ships. While this tendency was discernible in 1955, to fit full air-conditioning is now almost universal in new passenger liners and old ones are being converted. This trend has brought to the fore the need for efficient thermal insulation materials. Some of these newer materials have also made a definite contribution to the aim of devising satisfactory methods of freezing fish at sea. There are now signs that the point has been reached when rapid expansion will be possible.

Another trend is the increased interest which is being shown in the jacket system of insulating a cold room. (ref. 1). The jacket system has many advantages over the conventional method of cold room construction. It produces ideal conditions for the storage of frozen foods and offers one of the few practical solutions for the problem of insulation deterioration due to moisture condensation and it allows greater flexibility in evaporator design. It is very doubtful whether the jacket system increases plant construction costs by only approximately 10 per cent. Principles of operation and design were discussed and other methods for improving conditions in cold rooms

and for solving the insulation problems were compared with the jacket system. Heat transfer measurements were also dealt with (ref. 2) and the design of jacketed Russian store was described (ref. 3). The application of this type of cold store for preserving fresh fruit and vegetables was discussed in some detail. (ref. 4).

Problems

Several papers were devoted to current problems with thermal insulation. The influence of convection (ref. 5) has been studied in greater detail and the known fact that free convection added considerably to the heat leakage of an insulated wall was emphasized. The problems arising when using mineral fibre insulation were described, but contrary to experience, it was suggested that, when using slab materials in the tests described, there appeared to be no advantage. The accuracy of the test results owing to variations which existed in the installation methods was questioned during the discussion and it would appear that further work would have to be done before any definite conclusions can be reached.

An interesting study (ref. 6) was the influence of the capillary suction effect on the infiltration of moisture in sheet insulations of asphalt impregnated paper. The facts and figures quoted, particularly those given in fig. 2 of the paper, should be quite useful.

The severe difficulty of dealing with combined heat and moisture flow was emphasized in a paper devoted to this subject (ref. 7). The only hope for the development of a quantitative approach lies in experiment guided by the best possible understanding of what goes on. Perhaps ways can be found by which measures of the characteristics of the pore system can be used to establish empirically, rather than theoretically, and on an averaging rather than a spot basis, the desired relationships for any particular material. Further work on this problem is undoubtedly necessary so that a greater understanding of the interrelation of temperature and moisture gradient can be reached particularly relating to the observation that the movement of moisture in some cases is in the opposite direction to the vapour pressure gradient. This paper came under severe criticism. Several of the speakers indicated that what the author has proposed was by no means new. It had already been covered in 1940 in a German paper dealing with the whole subject giving formulae as well. Unfortunately the author was not present to give his observations as the paper had been read on his behalf.

The paper dealing with adsorption isotherms on insulating materials (ref. 8) suffered considerably by the fact that it had to be abbreviated. The author, however, was able to cover the subject much more fully in his address and the paper was of such interest that his exceeding the allocated time was willingly conceded. It is hoped, however, that in the final proceedings of the conference, it will be possible to cover the subject fully and to include all the subject matter that the author introduced which was additional to that which appeared in the pre-print.

Moisture condensation in insulating materials is always an important subject and, among the problems of thermal insulation, this is no doubt the most challenging to the refrigeration industry. The disastrous effect of condensation in fibrous materials was described (ref. 9) and a variety of results were quoted. This appeared to be a clear case of misuse of materials and only emphasizes the need for greater care in selection.

Materials

It was regrettable that the lecturer from Japan was unable to be present as his paper (ref. 10) comparing thermal insulation materials for rapidly cooled low temperature chambers, was quite informative. He had used cork, expanded polystyrene, silica aerogel, and expanded ebonite in his investigation. Figures and graphs were quoted. Unfortunately, in the case of expanded ebonite, a density nearly twice as great as that of the commercial grade available in Europe was used and in those circumstances the results obtained with this particular material were not as significant as they might have been and he is, therefore, led to the erroneous conclusion that the heat leakage is a minimum when expanded polystyrene is used.

Reflective insulation and other new insulators characterized by low mass and little heat storage capacity are used in refrigerated storage. The author dealing with this subject (ref. 11) pointed out that this characteristic of reflective insulation requires special consideration for satisfactory application. He gives a fairly detailed consideration of the problems involved.

Generally speaking, there is but scanty information on low temperature properties of thermal insulation materials. Some of this lack was met by a report on recent tests on expanded ebonite. (ref. 12). It was shown that compression strength, tensile strength, impact strength and shear strength are affected to only a small extent even down to -196°C ., the temperature of liquid nitrogen. Thermal conductivity results and tests on the coefficient of linear contraction at very low temperature were also dealt with in the paper. The paper concluded with a description of the use of expanded ebonite in low temperature insulation including liquid gases such as ammonia, ethylene and methane. The usefulness of expanded ebonite in the transportation of liquid methane was emphasized and a film was shown the same evening entitled "Aluminium for sub-zero methane." This showed how expanded ebonite was used in the insulation of a 2,000 ft. 10 in. diameter aluminium pipe at -160°C . (-256°F .).

The use of rigid polyurethane foams had already been referred to in an earlier paper on ships, insulation and an entire paper on this subject (ref. 13) showed how certain polyisocyanate rigid foams can be made *in situ* without involving any substantial toxicity hazard. The paper was full of interesting information and a lively discussion ensued. The subsequent colour film showing the foaming considerably speeded-up gave everyone a good idea of how the operation is carried out.

On the subject of the coefficient of thermal expansion of expanded polystyrene, a comprehensive paper (ref. 14) was given using simple yet effective apparatus. It was observed that the change of length of expanded polystyrene in cooling down and heating up gave a "hysteresis" loop which, as far as is known, had not previously been observed. It was also shown that there is a great difference between the shrinkage of samples below 1-lb./ft.² in density and those of the samples of higher density. It would be useful to know what results would be obtained on this apparatus on the other insulating materials and it is hoped that these will shortly be available.

Testing

It would not be possible to deal with all the tests and test methods which were proposed and discussed at the congress, but there are three which may be quite important; one (ref. 15) dealt with test apparatus for testing water vapour transmission. Another (ref. 16) described a short duration test for insulated rooms. This dealt with the subject on theoretical grounds, but there is no doubt that it was a valuable contribution to this type of problem. Yet another (ref. 17) dealt with the measurements made on board ship on the heat conductivity of various insulating materials.

General

The properties of the ideal ship insulator were listed (ref. 18) and methods of insulating ships' holds were described (ref. 19). The use of foil insulation (ref. 20) as disposable insulation gives food for thought and a useful practical paper on insulated chambers (ref. 21) gives the results of heat balance tests on a variety of types of refrigerated cargo ships with special reference to the type of insulation material and the lining used. An analysis is made of the results of balance tests on domestic store rooms with comparisons between chambers insulated with polyurethane rigid foam and traditional materials. The economics of varying thicknesses of domestic stores is also analysed using the available information on heat transfer coefficients.

Visits

Owing to the heavy lecture programme, it was not always easy for participants to disentangle themselves for the purpose of visiting cold store installations. There were, however, two outstanding tours which proved of interest to all concerned.

Firstly, there was the visit to Copenhagen Fish Market where 35,000 square metre area was devoted to the storage of fish in crushed ice; 12 tons of ice per day were made continuously for packing into the trays. There was a total refrigerated capacity of 3,635 cubic metres. The thermal insulation throughout this relatively new store was carried out with expanded polystyrene. As the store was only four months old, it is not possible to say at this stage how its life will compare with other insulating materials. Secondly, there was a visit to the Elsinore Shipyard which proved of interest as a 5,600-ton cargo vessel was being insulated in the fitting-out basin. This vessel was designed for the carriage of refrigerated cargo. It has a total capacity of 230,000 c.ft. at -20°C . It will be capable of 19.2 knots. The main insulation was being carried out with glass wool on the walls and cork on the tank tops and pipe sections. All the insulation was faced with aluminium. The standard of workmanship and some of the installation techniques employed were excellent.

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- ¹⁸ WESTLING, L. L. "Insulation of ships."
- ¹⁹ BRENDENG, E. "The Insulation of ships' holds."
- ²⁰ COOPER, G. E. B. "Disposable insulation and portable refrigeration for orange cargoes."
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Kelvinator will be celebrating later this year the 45th anniversary of domestic electric refrigeration. They introduced what is claimed to be the world's first model in 1914, in Detroit. Geoffrey Stenning, publicity manager, left last month for the United States to clinch final details of plans made to mark this occasion during the recent visit to the U.S. of Mr. N. F. T. Saunders, managing director of Kelvinator Limited.

ULTRA LOW TEMPERATURES

Surveyed by G. G. HASELDEN, Ph.D.

MANY good papers were presented in commission I although the papers as a whole could not be considered as a representative commentary on the present state of low temperature physics and the low temperature industry. No doubt this was due in large measure to the fact that no activities in these fields exist in Denmark and therefore there were no low temperature specialists on the Danish organizing committee. As with the other commissions however, the lectures were well attended and lively, and the major difference was only that the temperature difference between the subjects discussed and the audience was even more marked!

Main emphasis will be given in this summary to the technical rather than the purely scientific papers. Two sessions were devoted to physical phenomena at low temperatures. The first was concerned primarily with the behaviour of fluids and included reports on new apparatus for P-V-T studies and viscosity measurements at Louvain and Leiden, theoretical features on the form of the Joule-Thomson inversion curve and on a new equation of state. The second dealt with properties of solids at very low temperatures and included papers on magnetic effects and internal friction measurements in metals and various salts.

Part of a further session was devoted to low temperature thermometry. No striking advances were reported but useful survey papers were given. C. R. Barber of the National Physical Laboratory reported new high-precision gas thermometer measurements in the range 10 to 90° K. and made proposals for standardization of platinum resistance thermometers for use in this range. H. H. Plumb from the National Bureau of Standards in Washington described the consolidation in the field of low temperature thermometry which was taking place there. A paper by I. A. Pavlova reported the use of semi-conductors for measuring very low temperatures at his laboratory in Moscow.

The papers given on the technical aspects of the liquefaction and transport of helium and hydrogen did not adequately reflect the enormous developments which have taken place recently, especially in relation to hydrogen for rocketry. One paper reviewed the advances which have taken place in the U.S.A. in the design of vacuum insulated containers, so that liquid helium at 4° K. can now be readily shipped by road, rail or air, and can be stored for a week or two with a total evaporation loss of only a few per cent. Authors for the laboratories of the French Atomic Energy Authorities at Saclay described equipment conducting experiments at liquid hydrogen temperature within a pile. The equipment included a small bore pipeline nearly 30 yards long for conveying liquid hydrogen to the experimental cell. The pipeline was shielded with liquid nitrogen and was made from very thin stainless steel tubes so that very little liquid hydrogen was evaporated during the cooling-down period. Most of the insulated tanks and pipelines used in low temperature duty employ evacuated powders as the preferred type of insulation. Some of the anomalous flow conditions which occur during the pumping-down of fine powders have been examined in the research laboratories of the British Oxygen Company and this work was reported by A. G. Monroe.

The production of refrigeration at low temperatures by small compact machines employing modifications of the Stirling air-cycle is gaining in importance. These developments were largely pioneered by the Philip's gas expansion

machine which is now being used widely as a laboratory air liquefier. An author from the Philip's Company, Eindhoven, gave a paper describing the application of the same machine to cool an insulated cold box. Cooling of the box is achieved by the circulation of cold air from the gas-expansion machine. Temperature control of the cold box has been made automatic. The box has a capacity of about 12 c.ft. and can be held at any temperature down to -160°C . An obvious application of this cold box is the cold treatment of special steels.

W. E. Gifford of the Arthur D. Little Co. (U.S.A.) described two novel developments of the gas-expansion machine in which the emphasis was directed to duties such as the cooling of super-conducting computer elements (cryotrons). The requirement in this case is for an easily portable cooling source of small refrigeration capacity. The first unit described was a direct application of the Stirling cycle but the mechanical arrangement was quite different from that employed in the Philip's machine. It consisted of a main unit which housed the reciprocating expander (with dynamo-brake), valve gear and regenerator; this unit was supplied with compressed hydrogen or helium from a separate source (a compression or cylinder). A fascinating feature of this machine was the degree of miniaturization achieved. A unit shown had an expansion engine bore of about $\frac{1}{4}$ in. and a total weight of a few ounces.

The second unit described was even more interesting because in addition to being capable of miniaturization it employed a novel cycle. It consists of a cylinder closed at both ends and filled, except for about a sixth of its length, by a displacer which can be moved up and down in the cylinder. Thus two cavities are created which can be varied alternately from zero to maximum size. The upper cavity which operates at near room temperature is connected to supply and exhaust parts. The lower cavity produces the refrigeration and communication with the upper cavity through a small regenerator. No actual compression or expansion is caused by the movement of the displacer, the cycle depends on the Joule heating and cooling effects. Thus, with the displacer in its lower position gas is fed into the upper cavity to raise its pressure from the initial to the final value. This is accompanied by Joule heating of the gas in the cavity. The displacer now moves upwards and the warm gas flows through the regenerator to the lower cavity. As the gas becomes cooled in the regenerator its volume diminishes and some additional gas enters through the inlet valve at constant pressure. The exhaust valve now opens and the compressed gas in the lower cavity expands out through the regenerator. In doing so it does work upon itself and against the surrounding atmosphere and so becomes cold. The gas gains heat in the regenerator and leaves at a temperature above the feed temperature. Finally the displacer moves downwards driving the cold expanded gas through the regenerator into the upper cavity and the excess into the exhaust port. The available refrigeration is equal to the nett change of enthalpy between the feed gas and the warm exhaust gas.

A one-stage machine of this type may be used to provide cooling down to a temperature of 40°K .; for lower temperatures several stages in series may be used. This novel cycle is likely to be less efficient than the Stirling cycle but the unit is easier to construct.

Two papers were given dealing with the separation and liquefaction of methane. T. Sato from Japan described a novel plant for concentrating the methane in the drainage gas from coal mines. The feed gas to the plant contained 50 to 60 per cent. methane and this was increased to 90 per cent. in the product gas. Since the diluent of the feed gas was mostly air a major problem was the avoidance of explosions within the plant. For this reason the residue gas rejected from the plant still contained 25 per cent. methane to bring it above the upper explosion limit. The plant employed regenerators to purify the feed gas from moisture and carbon dioxide, and an expansion turbine to provide refrigeration.

A paper from a Russian author, A. P. Kleemenko, described a single flow cascade cycle for the liquefaction of methane or natural gas. The recommended cycle employed the mixed refrigerant system and gave some of the advantages of a cascade cycle whilst using only one compression. The paper raised

one or two interesting problems but the author was not present to answer them.

The remaining important topic dealt with by commission I was air separation. Two papers were presented by Russian authors, one described briefly the salient features of present-day large Russian oxygen plants, the second discussed the construction of expansion turbines for use with them. A novel feature of the oxygen plants described was the use of three regenerators instead of two for cooling the feed air and rewarming the reject nitrogen. The full reasons for using an extra regenerator were not apparent, and again the

author was not present to answer questions. A further innovation described was the adoption of separate insulation of components of large plants rather than the use of an insulated cold-box.

M. Ruhemann (Petrocarbon Developments Ltd., U.K.) described a novel plant for separating air to produce as sole product 340 m³/h of high purity nitrogen, normally at a pressure of 8 atmospheres absolute, but with the option of producing a small part as liquid. The plant used a single column operating at 8 atmospheres. Refrigeration was largely produced by a small turbine running on air-bearings.

THE ENGINEERING ASPECT

FROM a technical point of view the congress might be considered one of a transitional nature, many of the papers and much of the discussion dealing with research work at the stage where it is not sufficiently advanced to be directly useful. The effect of much of this current research will probably be seen at the next congress.

However, a paper given by C. Hoen of Holland described a fully automatic plant for producing ice in the form of blocks without the use of brine or ice cans. The evaporator, submerged in a large tank of water, was of the flooded ammonia type comprising groups of almost vertical tubes, connected to bottom headers around which the ice formed into rectangular sectioned blocks having corrugated sides. On completion of freezing, automatically controlled on a time cycle, hot gas is automatically admitted to the evaporator and the blocks suitably guided, rise to the surface of the water from where they are transported neatly by a conveyor system to a discharging platform before entry to the ice store. The weight of the block may be controlled within limits by the cycling time and it is possible to make tubular ice and also clear ice by air agitation methods. It is claimed that a 50 lb. block can be frozen in three hours when evaporating at 14° F., and that due to this fast freezing time the melting rate is slower.

G. Lorentzen and O. A. Baglo, of Norway reported on an investigation into the working of the gas pump recirculation system (Watkins). The advantages of using a mechanical liquid recirculating pump on a flooded system were weighed against the possibility of mechanical pump failure. However, the authors did not at this stage wish to make a comparison of the reliability between the two methods but rather to compare their efficiencies. It was thought that the initial cost is not substantially different but that there is a greater loss of refrigerating capacity and power with the gas pump system and to keep these losses to a minimum, the recirculation rate for large bore pipe ammonia air coolers should not exceed about two. Also the design of the pumping vessel should receive careful consideration. A gas pump using flash vapour at intermediate pressure can be designed to be loss free. Much interest was shown in all sessions on jacketed cold stores. Excellent material was prescribed by the Canadian and Russian delegates and it becomes increasingly obvious that the methods discussed have some great advantages over the more conventional approach. C. P. Lentz of Canada outlined some of these advantages as providing uniform temperature, high and uniform relative humidity low and even air velocity. Deterioration of insulation, due to condensation and freezing is reduced, particularly where internal and external tempera-

tures vary and where joints are subject to flexing as in refrigerated chemicals. Frosting of the evaporator is reduced. Initial cost is somewhat higher than for conventional construction as is also the running cost due to the larger fan for the jacket system but against these should be set the improved insulating valve. The design of the air jacket is of considerable importance, it being the aim to distribute the air in proportion to the heat to be absorbed.

Thermoelectric refrigeration was the subject of a number of papers, and one by V. S. Martynovsky and V. A. Maer of U.S.S.R. compared this with currently practical systems. Besides being noiseless and free from working parts, no working substance is required and control is very easy. The case of conversion for use as a heat pump was pointed out. However, it was stressed that at present the efficiency is considerably lower than mechanical and absorption refrigeration with the exception of the electrically heated absorption type.

In the field of domestic cabinets where the running cost is of less importance than in most cases, efforts are being made to provide a practical system. The authors held the view that current semi-conductor refrigerators have an efficiency about equal to that of an absorption system using electrical energy.

Ashley of the U.S.A. said that it is now possible to solve most problems of nuisance from noise by scientific methods. He indicated that a standard and guide would be published in the U.S.A. within one or two years. British delegates were worried because the degree of acceptance of noise varied throughout the world and particular reference to the alleged difference between American and British requirements. Ashley thought the degree of acceptance would prove to be comparable when measured scientifically. He stressed the importance of eliminating the nuisance value of a particular noise by mastering it with another background noise of much lower nuisance value.

A. Kramish of U.S.A. outlined the possibility of using nuclear heat to operate refrigerating plants. This heat could be used to produce electricity for electrically driven plants, steam taken directly from the reactor core could be used to drive the compressors, but the direct application of heat to absorption plants seemed to offer the best possibilities.

In addition to the commission meetings many technical visits and excursions were arranged some of which, because of the limited time available, ran concurrently. This part of the congress programme covered a very wide range of refrigeration applications, mainly to the food industry, and although general practice does not differ greatly from our own, certain features were notable. For example, commonly in the very large

installations the engine rooms were at ground floor level and much of the interconnecting piping and ancillary equipment housed in a basement below. Vibration was negligible, antivibration measures for the compressors usually consisting of cork mats. V/W compressors appear to be entering the Danish field to about the same extent or perhaps slightly less than in our own. Almost all plants use ammonia, "Freon-12" installations being relatively uncommon. A not unusual practice on ammonia plant is to employ a suction line liquid separator through which the liquid line is passed in the form of a coil, provision being made to pump automatically the liquid in the separator vessel to the liquid receiver should the level reach a dangerous limit. Inland, condensers of the forced convection evaporative type are most common but for coastal installations, of which there are many, the vertical shell and tube type cooled by sea water are almost invariably used. The average life of the tubes appears to be about seven years. By using the maximum of automation and making the utmost use of personnel some processing plants employ quite small labour forces. One could not help being impressed by the high standard of hygiene so important in these food processing plants most of which work on a co-operative system under which a large number of small farmers send small quantities of produce e.g. milk, cattle, pigs, fish, poultry and eggs, to a central station. A combination of these co-operative organizations own works where certain items of engineering plant are produced for the members of the system.

During an early morning visit to the Copenhagen fish market numerous varieties of fish packed with ice in timber boxes were on display. The ice was of the flake variety made from fresh water by a machine which was installed at the top of a 15 ft. sq. insulated tower forming the ice store into which the ice was fed directly from the ice machine. The floor of the store was at first floor level the ice being allowed to escape with the aid of some agitation through an opening in the floor into wooden trucks below as required. During short storage in these trucks the ice at the top fused to form a "pie-crust" which maintained the ice below in very good condition.

A large ice making plant in Esbjerg producing opaque ice, in 410-lb. blocks for use after crushing by the large local fishing fleet was inspected. Ice was stored in block form at 22° F. for periods varying from several days to several months. No packing was used between the blocks which were stacked to a height of about 8 ft. without the blocks sticking to each other. Thawing which was carried by water spray pipes attached to the tipping cradles, and which took about 5 minutes, was actually carried out in the tipped position, the idea being to minimize thawing time, each block leaving the mould as soon as it became free. The ice store is cooled by means of flooded coils through which ammonia is circulated by the Watkins system.

An unusual feature at a milk processing plant having a potential capacity of 50 tons per 24 hours was the use of stainless steel shell and tube multi-pass milk coolers each having a total capacity of 4,400 Imperial gallons per hour when cooling milk from 64 to 41° F. The flow of liquid ammonia to these coolers was controlled by low pressure floor valves and the minimum temperature of the milk leaving the coolers was limited to 38° F. by means of thermostatic control of the compressors according to the milk outlet temperature. Each cooler was provided with a displacement vessel above into which the ammonia could pass during cleaning of the cooler with hot water or steam, and on each vessel was fitted an automatic float switch control to prevent dangerous liquid levels occurring.

Delegates had the opportunity of seeing the most modern margarine factory in Denmark (probably in the world) which together with its sister companies produce about 50 per cent. of the Danish consumption. Perhaps the most interesting section of this works is that where the margarine is cooled wrapped and packed. In this section, which was glass panelled and air-conditioned, measures taken to ensure a very high standard included the maximum use of stainless steel, the cost of which must have been staggering. Most of the margarine coolers comprised six 4-in. diameter sections of the ice cream freezer type, arranged in series and on low pressure

float valve control, through which the product was pumped under considerable pressure. Subsequent wrapping and packing was highly mechanized and automated, the number of plant attendants being noticeably low. The five refrigerating compressors were of the V/W type, having a total capacity of 5,000,000 B.t.u./h at 5/86° F., and were direct-coupled to squirrel cage motors with pole-changing arrangements for speed reduction from 720 r.p.m.

The store of a small egg packing station was cooled by means of flooded ceiling grid coils, no provision being made for the addition of fresh air or for the control of humidity.

At the atomic research station at Riso a small reactor producing 5 megawatts and a larger 10 megawatt reactor due to become critical in about six months time were shown to the delegates, sufficient cooling for these being obtained by the use of water cooling towers. Experiments on the effect on food of radiation is being carried out at this station and an opinion was expressed that radiation treatment, at present very expensive, may eventually be used in conjunction with refrigeration for the preservation of some foods. There are certain disadvantages however, one of these being that meat has an objectionable odour after treatment which is not dangerous. An exhibition of potatoes about six months old showed the untreated ones to be rather shrivelled and to have long shoots of about 12 in. in length whilst those which had received treatment looked in very sound marketable condition. Carrots have also been treated with a certain measure of success and although it is claimed that in the example quoted no loss of flavour results this process is far from being a practical proposition owing to its enormous expense.

One of the most interesting installations visited was a large cold storage and freezing plant, called Agricold, of 8,500,000 c.ft. capacity having six floors and connected to the Esbjerg quayside and the slaughterhouse by closed corridors. The first floor is devoted entirely to the freezing of beef, pigs, poultry, lambs and butter, provision being made to freeze the beef in halves up to the rate of 95 tons per day. The beef is conveyed through a working room to the chill rooms held at 32° F. by air cooler batteries and taken from there to the freezing rooms, some at -40° F. and others at -58° F., part of this lower temperature capacity being used for freezing boned beef. After freezing, but before storage at some temperature down to -13° F., the beef halves are quartered in the work rooms which are directly connected to the lifts and by double air locks to all low temperature rooms. The building is insulated with about 10 in. to 11 in. slab cork on the envelope principle and frost-heave is prevented by the use of a ventilated basement below ground level. Flooded ammonia evaporators are used throughout and the vertical, reciprocating compressors are arranged in three groups, single, double and triple stage for use on the appropriate temperature duty. Crossover connections are provided for putting any compressor on any duty.

Chilling, freezing and storage are all carried out by forced air circulation coolers constructed from 1½-in. bore steel piping. In the case of the store the air is blown across the room between false walls forming air ducts whilst in the case of the chilling and freezing rooms air is circulated through a false ceiling by means of a hand-reversible fan. Hot gas defrost is used, there being no need to enter the cooled space as access to the rear of the coolers from a special corridor is possible. The partially thawed frost is fed by a special pipe shaft to waste. The complete installation is built under Lloyd's survey to obtain the notation + R.M.C.

Last month Mr. M. T. Zarotschenzeff, a pioneer exponent of the quick-freezing process through his "Z" system, celebrated his 80th birthday in Los Angeles where he now resides. Our older readers will remember "Mr. Z" when he was living in this country in the "early 30s" and will also probably recall his book "Between Two Oceans."

Postscript to the Congress

From G. E. JENNINGS



FOLLOWING the exceedingly interesting week of the 10th International Congress of Refrigeration in Copenhagen, the author took advantage of the technical excursion no. 5. This excursion embraced visits over the whole of Jutland and was spread over a complete week, ending on the following Wednesday evening. It turned out to be a very strenuous week with numerous visits to cold stores, slaughterhouses, ice-making plant, manufacturers of refrigeration machinery and controls. During these visits a great deal of technical information was gleaned and a really useful interchange of ideas took place. The visits usually ended with the party gathering around a table laid out in the most attractive style with plenty of refreshments. This typical Danish courtesy and hospitality was much appreciated and at first it was rather strange to see ladies drinking beer and smoking cigars, but this, of course, is quite normal in Denmark.

In addition to the official programme, time was also found to make several visits of historical and general interest, these not only included such obvious places as Kronsburg Castle (the home of Hamlet—in fact, for those who do not already know, a plaque to William Shakespeare is to be seen built into one of the walls) but other intriguing and unexpected items were brought in, such as a mink farm in which thousands of pounds' worth of furry delight were to be seen—but not touched! Or again to visit a trout farm, where once again glittering hues could be seen as the "meals to be" could be spotted in their thousands darting about through the water. On another occasion we visited an open-cast brown coal field, not as fascinating to the ladies, but interesting nevertheless, particularly as it was far removed from refrigeration.

During the excursion, it was necessary to stop in a different town every night, with the result that we took full advantage of the few hours available of finding out as much as possible about each town in turn. Obviously everyone will have their own preferences, but my vote goes unhesitatingly to Sønderborg, a town of quaint charm, cobbled hilly streets and a surprise around every corner; I would have enjoyed a much longer stay there, so that quiet strolls around the half

timbered houses and shops could be indulged at leisure.

One could reminisce over the visits at great length, probable to the utter boredom of any unfortunate reader or listener and therefore I will stop.

In my opinion the greatest value of the whole enterprise was to be found in one's associations with those taking part. For the majority of the trip (all travelling was done by coach) the party consisted of 35 participants plus the coach-driver and the guide/interpreter. Too much importance cannot be placed on the value and helpfulness of these two gentlemen; in fact, they contributed considerably to the success of the whole venture.

Of the participants it is interesting to find that 14 different countries were represented, I being the sole representative of the United Kingdom. I can imagine several people shuddering violently at such a horrible realization. The fact remains I alone was responsible for keeping aloft the Union Jack, but in spite of this handicap the relations were, without exception, extremely happy, despite the herding together to which we all had to submit; in fact, on one occasion having a very long journey to do, without interruption of visits, we organized a sing-song over the guide's microphone to which every nationality contributed. It was not very tuneful at times, but the spirit fostered would have made our politicians blush in shame.

The countries represented on this trip were as follows: Poland, Hungary, Sweden, Norway, Denmark, Belgium, France, Italy, Spain, South Africa, Australia, U.S.A., Germany, United Kingdom. Towards the end of the tour, I invited all participants to exchange with one another their business cards and the suggestion was received with enthusiasm; as a result I now have "full house" and can feel that I have a friend and valuable contact in each of these 14 countries. My last memories are of getting a taxi for, and saying "au revoir" for the Australian representative, Colin Christie, and his charming daughter Collete outside Copenhagen Central Station. It was truly "hands-across-the-sea," even to the other side of the world, a fitting close to the 10th International Congress of Refrigeration.

ABSTRACTS FROM I.I.R. CONGRESS PAPERS

(continued from September issue)

COMMISSION V

(continued)

Proposal for an international survey on the stacking density of foodstuffs stored in cold rooms. M. ANQUEZ and B. TIERSONNIER. *Ministère de l'Agriculture, Paris (France).*

The stacking density of foodstuffs in cold stores depends on the design of the store and on the handling system adopted. Manual handling, conventional in cold rooms of relatively small height, gives place to palletization with fork lift-trucks. The use of these devices requires more free space inside cold rooms, the efficient floor surface of which is therefore smaller. The usual stacking density for different foodstuffs in transit in cold stores are studied in both cases.

Economical methods of maintaining low temperature and high humidity in cold stores. S. F. PEARSON. *Torry Research Station, Aberdeen (United-Kingdom).*

The low temperature storage of inexpensive frozen foods in bulk, e.g. herring, is at present complicated by the expensive measures necessary to prevent dehydration. Present day jacketed stores are not the ideal answer to the problem owing to the expense of their construction and the complicated ducting required. Two new low temperature store designs are suggested.

Relative humidity in cold storage. Buffer effect of packaging. M. ROUSSEL and P. VIDAL. *S. A. Entrepôts Frigorifiques Lyonnais, Lyon (France).*

One is sometimes apt to give an excessive importance to the figure corresponding to "relative humidity of air." Neither its measurements, nor its interpretation are easy. The report describes some tests aiming to bring to light the difficulty of changing the relative humidity of a room containing a big mass of wooden packaging.

Odorous components in refrigerated warehouses. E. TANIKAWA and T. MOTOHIRO. *Hokkaido University, Hakodate (Japan).*

Generally, there are some odorous components in the atmosphere of refrigerated warehouses. The AA. have attempted first qualitatively to detect the odorous components which were produced in warehouses where fish, meat, and fruit were stored.

Water problem in refrigerating plants. P. PELLE. *Glacieres de Paris (France).*

After a summary of the disadvantages attendant on the operation and the economy of cold-stores without ample supplies of cooling water, the A. briefly describes the water system of a new cold store, at present being built in France on ground far from any natural water supply and without a subterranean reservoir of water.

Insulated doors for cold stores at low temperatures. M. P. JAUNIAUX. *Technical Service of Refribel, Brussels (Belgium).*

This paper describes the type of insulated door adopted at present at Refribel for cold rooms at temperatures of about -20°C .

The study is based on Refribel's long experience in this field, on thermo-dynamical calculations and on a method of electric analogue for drawing isotherm curves in a section of the door.

Handling in cold stores

Handling equipment: design, use and output in a group of public multi-purpose cold-stores. C. SALLES, J. DALAS and J. PAU. *Compagnie des Entrepôts et Gares Frigorifiques, Paris (France).*

After recalling the importance of handling in the operation of a cold store as well as the special conditions pertaining to

this industry, the AA. report and study the means used in a group of public multi-purpose cold-stores (small, average, big capacity) for modernizing handling.

First principals being defined, the special requirements of each plant must be taken into account (arrangement of spaces, kind of activities, loading capacity, efficiency).

1st stage: adoption of mixed palletization-manual handling.

2nd stage: overhead networks with equipment adapted to the various foodstuffs; conveyors and mainly belt conveyors.

3rd stage: complete palletization.

In each case, the results obtained are given: improvement in efficiency (instantaneous and overall), increase in facilities of reception and delivery, financial efficiency, etc. . . .

The examples studied enable the definition of criteria for the modernization of existing plants, in terms of each particular case, and the determination of the effect of handling methods on the general design of spaces in the case of new construction or of enlargement.

Use of complete palletization of foodstuffs in cold-stores. C. SALLES, J. DALAS and P. FOULET. *Compagnie des Entrepôts et Gares Frigorifiques, Paris (France).*

Among the solutions suggested for improving the efficiency of handling, complete palletization is especially interesting, since it results in elimination of damage caused by handling.

The advantages of this system are of two kinds:

- (1) for handling proper (transport and above all stacking);
- (2) for cold storage, to the special conditions of which palletization is well adapted.

Economic problems of operation

The cost and losses of kern fruits during storage. P. GREIDANUS. *Institute for Research on Storage and Processing of Horticultural Produce. Wageningen (Netherlands).*

The Netherlands produce an important quantity of kern fruits, of which a large part is suitable for storage. This enables a staggering of the supply of the fruit. The methods of storage of these kern fruits are: (a) air-cooled storage; (b) refrigerated storage; (c) storage in controlled atmosphere.

Comments on the nomenclature of operating characteristics of cold stores from a technico-commercial standpoint. P. LEMBERT. *Compagnie des Entrepôts et Gares Frigorifiques, Paris (France).*

The comments are related to the criteria according to which operation facilities of public cold stores must be taken into account. The main operating characteristics which must be retained for a cold store must be strictly determined and defined so that the comparison between two stores cannot raise any doubts between the users.

Principles of accounting for goods in a group of cold stores. D. PAGNOUX, R. LANNIER and J. DALAS. *Compagnie des Entrepôts et Gares Frigorifiques, Paris (France).*

The accounting described has been used for more than 15 years in a group of firms including average and large cold stores.

Technical operation of cold stores

Technical and economic data on freezers and storage rooms at cold stores. N. F. TKATCHEV. *Moscow (U.S.S.R.).*

Goods stored in cold rooms should be stacked so as to exclude any damage to the building constructions or to the equipment of the cold rooms at a maximum utilization of the capacity of the rooms. The goods should also be accessible for inspection during storage. These requirements call for the necessity of elaborating and observing certain rules for charging and operation of cold rooms and freezers of cold stores.

Storage capacity for foodstuffs. Frozen storage capacity and coefficient of use. J. DALAS, J. PAU and H. MINAULT. *Compagnie des Entrepôts et Gares Frigorifiques, Paris (France).*

Knowledge of the density of storage of merchandise is an absolute prerequisite in the design and operation of cold stores. It is also necessary to establish the maximum capacity and the coefficient of use, which are important statistical factors.

Basic tariff principles for cold storage in France. P. LEMBERT. *Compagnies Entrepôts et Gares Frigorifiques, Paris (France).*

The system of rates used in France for the invoicing of public cold store services is detailed by the author. The development of conditions of operation of cold stores (palletization, standardization of packages) may result in the future in repercussions on tariffs.

Contribution to the study of the problem of efficiency in public cold stores. Analyses of cost price in the case of a chain of multi-purpose cold stores. Criteria of efficiency. P. LEMBERT, D. PAGNOUX and E. LANNIER. *Compagnie des Entrepôts et Gares Frigorifiques, Paris (France).*

The efficiency of a public cold store is expressed by the following criteria: financial coefficient of operation, coefficient of use of cold rooms, coefficient of renewal of stocks per year. The accurate estimation of cost price and of criteria of efficiency is an essential element for the interpretation of the results of operation of existing cold stores and for the contribution to the study of the efficiency of new equipment.

Types and activities of cold stores

Types and activities of cold stores. J. B. VERLOT, *Paris (France)* and N. TKATCHEV, *Moscow (U.S.S.R.).*

Commission 5 has undertaken the preparation of a "cold storage guide." This guide is intended to help in a study of the problems which must be solved by any person or firm wishing either to construct a cold store, or to improve the operation of an existing one.

Standard or non-standard cold-stores. Multi-purpose or special plants. G. GANGER. *Elelmcsugyi Miniszterium, Budapest (Hungary).*

The freezing capacity in Hungarian cold stores has been increased over the last 10 years in the ratio 1/4.5, the floor surface of the rooms at -20°C , by 1/1.65, that of spaces at 0°C was doubled. During the next 15 years, the present capacities will be still increased in the ratio of about 1/2.30.

A modern refrigerating plant for a slaughterhouse. J. LARIDAN. *S.T.E.F., Paris (France).*

Undertaken in 1957, the equipping of the refrigerating plant built in annexe to the slaughterhouses at Nice, which are being modernized, resulted in September 1958 in bringing into service, as a first step, five cold stores able to receive 300 tons of fresh meat at once, one of which is provisionally equipped for curing, the main air-conditioned sale-room and a freezing plant.

Prefabricated country cold-stores, with thermal insulation integrated in the bearing structure. U. SELLERIO. *Istituto Superiore di Sanità, Rome (Italy).*

In addition to large cold stores, small country cold-stores are often required, the capacity of which is only a few tons, i.e. corresponding to a maximum of about 10 refrigerated railway-cars. In this case, the construction of cold-stores with prefabricated elements is advantageous.

The experience of the state plant "Antrefrig" for the cold storage of foodstuffs. G. FITCHOU, M. MOURARIOU and M. NATCHEA. *Department of Meat, Refrigeration and Dairy Industry (Rumania).*

A plant for the cold storage of foodstuffs with following features, is described: storage of cooled or frozen foodstuffs, quick-freezing of fruit, vegetables and prepackaged meat cuts, of precooked or half processed food.

Quick-freezing

Comparative study of quick-freezing methods

The present state of knowledge of freezing of agricultural and food products. M. ANQUEZ, B. TIERSONNIER and G. MONCHALIN. *Ministère de l'Agriculture, Paris (France).*

The theoretical study of the freezing of tissues has been the subject of remarkable work. The AA. try to summarize present knowledge of freezing, from existing documents, and thus to obtain some general ideas.

Freezing rates of various foodstuffs in metal moulds in quick-freezing tunnels. L. MILLOT and J. DALAS. *Compagnie des Entrepôts et Gares Frigorifiques, Paris (France).*

The principle of the freezing process of foodstuffs in metal moulds in a tunnel has already been reported before commission 5. After summarizing the advantages of the process, especially well adapted to industrial freezing of big amounts in multi-purpose cold stores, the AA. describe the characteristics of the tunnels in which measurements were made during periods of continuous operation with full load.

Pre-cooling, quick-freezing and storage for quick-frozen fruit and vegetables. V. S. MEADOWS. *Westwick Frosted Products Ltd., Westwick (United-Kingdom).*

The importance of pre-cooling before quick-freezing. The position of pre-cooling in relation to production flow and method of stacking for pre-cooling are vital links in the chain of quick-frozen food production.

Belt freezers for peas. P. O. PERSSON. *Helsingborgs Fryshus Aktiebolag, Stockholm (Sweden).*

One condition for obtaining good quality when freezing vegetables is that they be frozen as soon as possible after harvest. For a product such as peas, for which the demand for frozen ones is so great that in Sweden the production amounts to about 5,000 tons a year, freezing equipment is exposed to enormous strains during the short harvest time. In Sweden the harvesting season is about six weeks. A description is given of the construction of a belt freezer for peas, having a capacity of 100 tons per 20 hours. After dewatering, the peas pass through a compartment with a temperature of -10°C , and then the real freezing follows at -35°C . In addition to data regarding quality and capacity, estimated costs of the freezing procedure are given.

Prevention of spoilage of brine in Ottesen's freezing system. E. TANIKAWA and T. MOTOHIRO, *Hokkaido University, Hakodate (Japan).*

In Ottesen's freezing method, if the operation is stopped for a long period, the nitrogenous material which has dissolved out raw fish into the brine, causes damage by spoilage in the brine owing to increase of temperature and the brine produces a stench odour. In order to prevent the spoilage of the brine addition of five p.p.m. concentration of nitrofurazone (5-nitro-2-furfural semicarbazone) to the brine is available, as an antiseptic.

Discussion of standardization principles for quick-freezing

Report of present applications in the standardization of quick-freezing equipment, of conditioning and packaging of frozen products. C. SALLES and P. LEMBERT. *Compagnie des Entrepôts et Gares Frigorifiques, Paris (France).*

In the field of industrial quick-freezing the main applications during recent years are related to the freezing of fruit, refrigeration having markedly improved in this field. Freezing, considered as a means of storing fruit for subsequent processing, involves the respect of very severe criteria (preparation immediately after picking, protection against oxidation, proper conditioning, quick-freezing at -30°C , storage at -18°C). The technique described ensures the best results in the keeping quality of fruit and has started an important development of industrial freezing of fruit for processing in France. In consequence, the practical applications of this technique are very widely used and a survey of the different fields of possible application stresses its importance.

Some trade margins and prospects for European retail-pack, quick-frozen food. H. J. ONNES. *Zeist (Netherlands).*

Based on data given, this paper describes how much more the American "working minutes" for most perishables and cheaper American mass distribution favours quick frozen food as compared with Europe, excluding Sweden. Structural changes (including higher eating standards, rationalizing (faster turnover, etc. . .)) must be developed before European quick-frozen food can compete with cheaper quicker distribution of canned and some fresh food.

On the need for international cooperation in the standardization of quick-frozen food. J. BAMBERGER. *F.I.C.U.R., Paris (France).*

The author deals with the present state of food quick-freezing in France and with the need for international regulations.

Water ice

Economical problems

Contribution to an attempt for higher economical efficiency of ice-factories. P. PELLE. *Glacieres de Paris (France)*.

In almost all countries consuming water-ice statistics showed a marked evolution of the production of ice since the war. In France, it is increasing in fish and transport industries, whereas it markedly decreases for retail-trade and household usage. The A. discusses the probable trend of this decrease and recalls the points requiring supplementary prospection or susceptible to gain new markets.

Ice making

Incremental freezing machine for rapid-manufacturing of block ice. H. YAMADA. *Nagoya Institute of Technology, Nagoya (Japan)*.

The incremental freezing machine for rapid-manufacturing of block ice invented by the A. has been improved.

Method of making ice blocks having approximately the usual dimensions and weights without use of ice cans. C. HOEN. *Grasso's koninklijke Machinenfabrieken N.V., 's-Hertogenbosch (Netherlands)*.

A description is given of a method to make ice blocks, having approximately the usual dimensions and weights, without using ice cans. The ice blocks are formed round groups of parallel, vertical tubes, which are part of a flooded evaporator.

Rapid block-ice manufacture equipment, also suitable for the quick-freezing of foodstuff in containers. E. WILBUSHEWICH. *Rapid-Ice Freezing Ltd., Zurich (Switzerland)*.

This system using direct evaporation is taking the place of the brinetank system with its wasteful space and personnel requirements. Over 120 Rapid-ice installations have been made during the last four years producing iceblocks of 56 to 400 lb.

New system or the production of ice in scrap plates. A. RICHELLI and G. PICCININ. *Samif, Milan (Italy)*.

The report deals with the production of a type of water ice particularly suitable, because of its physical and structural characteristics, for the conservation and transport of delicate and perishable foodstuffs and among which are fish products.

Storage of crushed ice or small ice

General problem of storage of crushed or processed ice. H. ALLIOT. *Nantes (France)*.

The A. studies the characteristics of different types of processed ice suitable for storage: crushed ice, tube ice, snow-ice, dry flake ice, as well as the most suitable methods of storage in silos. This general survey may be taken as a basis for an interesting reassessment between ice-manufacturers concerning the best and the most economic method of storage.

A practical method for storing processed ice in silos. G. BRUNET. *Glacieres de Paris (France)*.

The A. describes the silos for the storage of ice-briquettes, which are made in France under the licence of the Vilter Manufacturing Company, Milwaukee, U.S.A. and describes their use over several years, especially for the icing of railway-cars.

Storage of tubular processed ice in the tubular ice manufacture of the fish-market of Gesellschaft für Markt-und Kuhlhallen at Hamburg-Altona. K. HEINZE. *(Germany)*.

In 1956, on the wharf of Hamburg-Altona fishing-harbour, a new plant for the manufacture of processed ice producing 300 t/d was brought into service. Up to delivery, the ice is stored in a large tank containing 550 tons. After a description of ice-making and requirements of Hamburg fishing-harbour before 1956, the paper gives the principles of the construction of this new ice-manufacture.

Miscellaneous topical problems

The design and performance of an un-insulated freezer room in rock. G. LORENTZEN. *Norges Tekniske Høgskole, Trondheim (Norway)*.

A freezer storage room and freezing tunnels were installed

in a cavity blasted out of solid rock, without insulation. The calculation of refrigeration demand was a three-dimensional problem of non-stationary heat conductance. The paper briefly describes the design and method of calculation used.

Italian refrigerating equipment. G. PERTICARA. *Italian Refrigeration Association, Rome (Italy)*.

The paper deals with Italian refrigerating equipment in general, and more especially in terms of Italian agricultural and commercial economy.

Development of the role of public cold stores, effect of preparation and conditioning of foodstuffs on the evolution and the development of cold storage. C. SALLES and P. LEMBERT. *Compagnie des Entrepôts et Gares Frigorifiques, Paris (France)*.

The establishment of the related activities of preparation and conditioning of perishable foodstuffs is justified by the scarcity of equipment which is logically appended to a cold store.

The cold storage of potatoes in bulk in a two-floor building. J. ORSHAN. *Haifa (Israel)*.

A cold storage plant for 2,200 tons of potatoes in bulk in a two floor building has operated successfully for two years at Atlit Cold Stores Ltd. near Haifa (Israel). The cost of construction of this plant appeared to be cheaper as compared to the single story plant by saving in cost of insulation, air ducts, and land.

Special clothes for people working in cold rooms. J. PAU. *Compagnie des Entrepôts et Gares Frigorifiques, Paris (France)*.

The conditions of work in cold rooms are abnormal. Their study makes possible the estimation of the requirements for the clothes of people working in cold stores, which moreover are not very different whether they are intended for processes of handling or of storing foodstuffs, for ice-making or operation of the plants.

COMMISSION VI

APPLICATIONS OF REFRIGERATION EXCLUDING FOODSTUFFS AND AGRICULTURAL PRODUCE

The heat pump

Experience with British heat pumps using waste warm water as a source of low-grade heat. M. V. GRIFFITH. *Electrical Research Association, Leatherhead, Surrey and N. C. MANDER. Central Electricity Generating Board (United-Kingdom)*. Several heat pumps of output capacity 100-600 kilowatts and utilizing waste industrial water at about 28° C. as the source of low-grade heat are in continuous use in the United Kingdom. Careful studies of the performance of some of these extending over three years have been made, and the results are described in the paper.

New method for combination of heat pump and refrigerating plant. L. HELLER and G. FARAGÓ. *Elektromechanikai Minisztérium, Budapest (Hungary)*. The Heller-Farago system has eliminated all these disadvantages to which heat pumps are prone, it is claimed, and without control equipments, solely through heat effects, ensures smooth operation even if the heat delivered by the cooling compressor is in excess of the heating demand or remains below it, or else, if refrigeration should discontinue altogether.

Results of six years operation of a heat pump. M. ROUSSEL. *Entrepôts Frigorifiques Lyonnais, Chalon-sur-Saône (France)*. This heat pump heats the works and offices of a factory making electrical equipment (Garday Co) near the cold store of Chalon-sur-Saône. For this heating some of the compressors of the cold store are used in winter. The maximum capacity amounts to about 600,000 kcal/hr.

Use of the heat pump with intermediary refrigeration in a modern country. M. LAGUILARRE and M. CIBOIT. *Paris (France)*. Description of a big factory producing condensed and powder milk making use of the heat pump. Description of whole equipment. Particular features of plants constructed and precautions taken to prevent any contact of the refrigerant with milk. Control of the whole plant.

Air-conditioning

Variations in mechanical systems for differing air-conditioning objectives. B. H. JENNINGS. *ASHRAE Laboratory, Cleveland Ohio (U.S.A.)*. The increasing use of summer and winter air-conditioning in many types of large buildings, such as offices, factories, hotels, schools, etc., raises questions as to what equipment arrangements can best meet specific objectives. Engineering and economic aspects of these complex problems are discussed in the paper.

Year-round air-conditioning of multi-roomed buildings for Central European requirements. W. LINKE. *Techn. Hochschule, Aachen (Germany)*. The year-round air-conditioning of multi-roomed buildings becomes necessary or preferable due to climate, dimensions and structure of the building, type of window construction, intensity of occupation, impurities in the external atmosphere, street noise, and the desire for automatic ventilation. A critical summary of the developments and trends in year-round air-conditioning in the U.S.A. and Germany with reference to claims on comfort and economic operation is made.

Possible use of mixed analogue methods for the investigation of plants. G. BURNAY and J. VIDAL. *(Belgium)*. In the field of electronic analogues, the laboratory has engaged in developing a computer for resultant environment temperature. This resultant temperature includes the effects of radiation, the influence of which on comfort is very critical in spaces conditioned by means of panels.

Considerations on the measurement of refrigerating effect of air-conditioning units. G. BURNAY and J. FAFCHAMPS. *(Belgium)*. The calorimetric method can guarantee the best conditions of reproducibility of tests. It seems certain however, that the behaviour of the conditioner remains influenced, for perfectly determined environments, by outside conditions linked to it, viz.: the size and the structure of calorimeters, the location of balancing batteries, the profile of fields of air speed in calorimeters, etc.

Sound control of air-conditioning and refrigerating equipment. M. ASHLEY. *Syracuse, N.Y. (U.S.A.)*. Research has been carried on in fan and fluid flow noise generation, duct attenuation and combustion noise by A.S.H.A.E. Series of papers on sound have been presented before A.S.R.E. and A.S.H.A.E. A joint standards committee is now preparing an equipment test standard based on comparing the equipment sound with a calibrated standard sound source in a reverberant room. Criteria have been proposed and evaluated for relating the measured sound pressure level and the psychological reaction.

New unique arrangements for the application of refrigeration in a large chocolate factory. A. STRADELLI. *Studio Tecnico Industriale, Torino (Italy)*. Description of refrigerating and air-conditioning plants, in a big chocolate factory, including new equipment.

Air conditioning in Sahara: possibilities and limits of evaporative cooling from the point of view of comfort. J. TIREL. *Comite Scientifique et Technique de l'Industrie du Chauffage et de la Ventilation, Paris (France)*. Summer weather conditions in Sahara open a wide field of development to evaporative cooling.

Industrial applications of refrigeration

Turbocompressor refrigeration systems in the chemical industry of plastic materials. O. CERVENKA. *C.K.D., Prague (Czechoslovakia)*. In the past few years turbocompressor refrigerating systems have been gaining application in the chemical production of basic raw materials for the plastics industry. The report deals with the problems of this branch of refrigeration technique from the point of view of technical solutions.

The production of liquid oxygen, hydrogen and helium by multiple expansion of the gas in expansion turbines. I. P. USYUKIN. *Moscow Institute of Chemical Machine Building, Moscow (U.S.S.R.)*. Low pressure (6 ata) methods have been suggested for the manufacture of liquid oxygen, with the refrigeration obtained at the lowest temperature level in the expansion turbines. Due to the thermodynamic imperfection of this method nearly twice as much power is consumed as in the case of high-pressure installations. The author lists principles to be observed in order to minimize the power consumption in the manufacture of liquid oxygen.

Heat pump applied to the regeneration of absorbent solution by dehumidification. (A new proposition to the drying by normal temperature). H. YAMADA. *Nagoya Institute of Technology, Nagoya (Japan)*. Because dehumidification by liquid absorbent is most adequate to deal with. In the drying of goods such as fish, whose quality is injured by the usual high temperature drying, a very large quantity of heat is usually necessary to eliminate the water content from these goods; this drying method requires the thermal efficiency as great as possible for the regeneration of the absorbent. The A. suggests the indirect heat pump method for the regeneration of the solution.

Flow of gases through packed powder beds at low pressures. G. MAIDANIK and A. G. MONROE. *British Oxygen Research and Development Ltd., London (United-Kingdom)*. In the course of the investigations reported in this paper, the authors have studied the permeability of fine silica powder for gaseous hydrogen, helium, air and "Freon." The pressure range considered was 0-550 microns mercury and the corresponding permeability figures not higher than 50 cm²/second.

Gas circulatory system for the transport of cold from the Philips gas refrigeration machine to a cold box. A. A. DROS and K. ROZENDAAL. *N. V. Philips Gloeilampenfabrieken, Eindhoven (Netherlands)*. The simplest method of conveying the refrigeration produced by the Philips machine over small distances is by means of a gas circulatory system. A special header has been developed for this system.

The investigation of heat conductivity in dams with piping refrigeration. A. G. TKACHEV and G. N. DANILOVA. *Leningrad Technological Institute of the Refrigerating Industry, Leningrad (U.S.S.R.)*. Results of investigations on the refrigeration of concrete masonry of high dams by means of pipes are discussed. Theoretical and experimental investigations were made on heat conduction in a concrete block with an internal heat source or without any. The tests were performed under laboratory conditions on cylindrical or prismatic models 360 and 545 mm. in diameter and 300 mm. the side respectively.

Cooling of concrete walls by water flowing in embedded pipes. S. I. NEUMAN. *Johnson and Fletcher Ltd. Salisbury (S. Rhodesia)*. This paper deals with the refrigeration requirements of the concrete wall of the new high dam across the Zambesi River. The paper evaluates the necessity of resorting to refrigeration at all and discusses the various methods available for this purpose and why after-cooling of concrete in situ has been selected.

Biological and medical applications of refrigeration

Crystallization and eutectic phenomena in biological products: experimental methods and results. L. R. REY. *Ecole Normale Supérieure, Paris (France)*. To establish the optimum conditions for freeze-drying of complex biological products, it is necessary to determine very accurately the temperature of complete crystallization. For that determination the eutectic phenomena must be studied and the different transformations occurring at low temperature must be studied.

General aspects of lyophilization research in Japan. T. NEI. *Institute of Low Temperature Science, Hokkaido University, Sapporo (Japan)*. The process of research development of

lyophilization in Japan during the past 20 years and current fundamental studies and practical utilization of lyophilization are described in detail.

Investigations in the freeze-drying of some enzyme products used in the food industry. A. SAVOU, A. TSCHIOBANOU and G. ADAM. *Food Research Institute, Bucarest (Rumania)*. The A.A. studied freeze-drying of pepsin and rennet, taking into account that such experiments are not quoted in specialized literature. Interesting results were obtained by using a medical lyophilization plant. The good results obtained show the future industrial possibilities for the storage of these enzymatic products.

Preservation of skin by cold after glycerol treatment. THEIL-LEUX, RABY, VIGNE, LONDON, MERIEUX, WEINMANN. *Services de Sante des Armees and L. R. REY, Y. DESTOBBELEIRE, O. TRAUTMANN. Ecole Normale Supérieure, Paris (France)*. To study the preservation of living skin numerous freezing experiments have been done on foetal and adult skin of different animals. Direct freezing in liquid nitrogen shows that the viability is very low and that the critical period is the thawing one. The conclusion shows that preserved skin can be used for surgical applications and the recent clinical date gives a good confirmation to that point.

Preservation of hematopoietic tissues for the therapy of radiation disease. A. LINGEROVA. *Ceskoslovenska Akademie Ved, Biologický Ústav, Praha (Czechoslovakia)*. The possibility of long-term preservation of viable tissues is an important factor in the therapy of radiation disease. Experiments are in progress to test different conditions of freezing and thawing that influence the therapeutic effectiveness of embryonic liver cells of mice injected into lethally irradiated mice of another strain.

The alteration of radio-sensitivity by extreme hypothermia. L. WEISS. *National Institute for Medical Research, London (United Kingdom)*. The experiments described represent an attempt to assess the alteration in radio-sensitivity produced in different tissues by hypothermia down to 1° C.

Design patterns for year-round air-conditioning of buildings. W. P. JONES. The emphasis in the paper is upon combinations of air-conditioning equipment which permit operation throughout the year. No discussion of design conditions in particular is proposed, but a survey of possible designs is made in the light of the possible zones on the psychrometric chart within the state points representing the chosen outside conditions may lie.

The investigation of a lithium bromide absorption refrigerating and heat-pump machine. L. M. ROSENFELD and M. S. KARNAUKH. *Leningrad Technological Institute of the Refrigerating Industry, Leningrad (U.S.S.R.)*. The water solution of lithium bromide is being used lately as the working substance in absorption refrigerating machines. The object of the work discussed in this paper was to show that waste heat (for example, in the form of hot industrial discharge water having a temperature of 60 to 75°C.) may be utilized by a lithium bromide absorption machine all year round in summer for cooling, and in winter for heating purposes.

The influence of condensation of air moisture on the friction losses in air cooling systems. W. HUFSCMIDT. *Techn. Hochschule, Aachen (Germany)*. The question, as to whether or not a high number of fins per unit length is suitable in finned tube systems for air heaters or coolers in air-conditioning units and convectors, has not yet been fully answered. Experiments show that the additional pressure drop due to condensation is a function of the air velocity and for small velocities, — that is in the operating region of air-conditioning units and convectors — may amount to a sizable multiple of the value associated with units with dry heat transfer.

Ideal processes for the separation of gas vapour mixtures. H. BOCK. *Leverkusen (Germany)*. Mixtures of gas and vapour, such as moist air, occur rather frequently, and their treatment is of great technical importance. A unit operation of a special

type is involved here which, however, has up to now hardly been dealt with systematically, because in every case the separation calls for condensation of the vapour component by refrigeration.

Interposition of refrigerating machines in technological processes. W. NIEBERGALL. *Technische Universität, Berlin (Germany)*. In many technological processes requiring refrigeration, the refrigerating machine is linked to the manufacturing process not only by means of the refrigerant evaporator for one of its stages, but also often by means of the condenser and even of the power supply for the operation of the refrigerating machinery. Absorption refrigerating plants often offer the possibility of using for refrigeration the heat lost by a technological process at high temperature, obtaining refrigeration at another stage.

Plants for vacuum evaporation and vacuum refrigeration and their application in the industry. T. MESSING. *Standard-Kessel-Gesellschaft, Duisburg-Meiderich (Germany)*. Special plants of the chemical and foodstuff industry increasingly employ plants with sometimes extraordinarily high capacities for the cooling of solutions or for the evaporation of solvents at temperatures which are within the capacity of refrigerating machines. Such plants may be called vacuum evaporating plants, and it is of no importance whether evaporation is effected for the purpose of refrigeration or for concentration or distillation of solvents. Three different forms of refrigeration can be employed.

Effect of freeze-drying on foot-and-mouth disease virus and vaccines. F. BROWN and J. CRICK. *Research Institute, Pirbright, Surrey (United Kingdom)*. Suspensions of the virus of foot-and-mouth disease (tissue culture fluids or extracts of infected animal tissues) have been dried under various conditions. Complete recovery of infectivity was obtained when the suspensions were dried at -15° C. in the presence of sodium glutamate but about 1 log unit of infectivity was lost if sodium glutamate was not added. The immunising properties of these dried preparations have been tested in animals.

The application of refrigeration for prolonged preservation of blood. F. R. VINOGRAD-FINKEL, F. G. GINSBURG and L. I. FYODOROVA. *Moscow (U.S.S.R.)*. The method of preserving blood at sub-zero temperatures (Cent.), resulting in a practically complete cessation of metabolism in the cells, is of great importance as it provides the possibility of considerably prolonging the period of blood preservation.

COMMISSION VII

REFRIGERATED TRANSPORT BY LAND AND BY AIR

Characteristics of refrigerated transport vehicles

A new ice-car with overhead cooling equipment. M. S. MARTYNOV, *Ministry of Railways of the U.S.S.R.*, and S. O. GOOSSEV, *All-Union Scientific Research Institute of the Railway Transportation, Moscow (U.S.S.R.)*. The serial construction of new and improved refrigerator cars having an enlarged body volume and overhead bunkers was commenced in the U.S.S.R. in 1958. Their body is 17 m. long and has a total internal volume of 117 m³. The useful volume is 82 m³. The outer covering of the walls and roof and part of the framework are made of low-alloy steel. The inner sheeting and the flooring are of sheet aluminium. Mipore plates in Perfoil packets are used for thermal insulation. The actual heat transfer ratio of the body enclosure is 0.31 kcal/m²/hour per 1° C. In comparison with the best previously built types of cars, the freight cost of perishable goods in such cars is 5 to 8 per cent. lower and the quality of the goods is better preserved.

The performance of a type of fan car cooled by ice. E. W. HICKS, *C.S.I.R.O., Homebush, N.S.W.*, and C. D. STEVENSON and J. R. BLAKE, *Department of Agriculture and Stock, Brisbane, Queensland (Australia)*. The performance of a refrigerator car fitted with American electric fans was studied in some detail.

REFRIGERATION

for Freezing ★ Storage ★ Display



The cold store of Eskimo Foods Ltd., Cleethorpes, is noteworthy as the first large installation of its type in this country to use finned cooling grids. The two large chambers, each with a capacity of 400,000 ft.³, and a smaller room of 35,000 ft.³, are automatically maintained at -20° F. by compound compressors made by J. & E. Hall.

J. & E. Hall design and manufacture all types of refrigerating equipment for the freezing, storage and retail display of quick frozen foods.

J & E HALL LTD

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The rate of heat transfer to the ice per unit temperature difference between the ice and the air entering the bunker varied with the speed of the fans but at constant speed it remained almost constant until more than half the ice was used. The melting pattern of the ice was different from that obtained without fans and the performance of the bunkers during relatively short periods with fans off was rather poorer than in similar cars operating continuously without fans.

Moisture condensation in the insulation of Canadian Railway refrigerator cars. C. P. LENTZ and E. A. ROOKE. *National Research Council, Ottawa (Canada)*. Variation in performance and weight of overhead ice tank railway refrigerator cars indicated considerable wetting of insulation during service. Methods of solving the problem are discussed.

An experimental van for transport of perishable foodstuffs and the measurement of heat transfer. H. VEENSTRA, *N.V. Esta, The Hague*, and P. NOORDZIJ, *Institute for Research on Storage and Processing of Horticultural Produce, Wageningen (Netherlands)*. Description of an experimental refrigerated van and measurement of overall heat transfer coefficient of insulated walls.

Refrigerated cargo containers. L. L. WESTLING, *Oakland, California (U.S.A.)*. During and since the war there has been developing throughout the world a politico-economic situation to which marine transport is particularly sensitive. The cost of marine terminal operation is such that remedial methods are demanded. The shortcomings of the refrigerated container are discussed as are the advantages as related to unfrozen, live cargoes.

Devices for accelerating the cooling of fruit and horticultural products in transport vehicles (precooling and cooling during transport). D. CANITANO, *Rome (Italy)*. The considerable increase in Italian exports of fruit and horticultural products towards countries of Middle and Northern Europe over the last 20 years is mainly due to the improvement in refrigerated transport, thanks to which it has been possible to extend the storage of fruit and vegetables and to transport them in good conditions to the most far-off markets.

Road transport controlled temperature. P. L. DROIN, *International Road Transport Union, Geneva (Switzerland)*. This report first outlines the reasons for the ever-increasing requirement of this means of transport and then mentions the technical characteristics of the different special vehicles that road carriers can now place at the disposal of the users: ventilated, insulated, refrigerated, mechanically refrigerated and heated vehicles.

Transport under controlled temperature by containers. J. LEVY, *International Container Bureau, Paris (France)*. Describes how the question of transport by containers of perishable foodstuffs has been put after the 1st. World War, and the conditions under which such transport took place between the two wars, during the 2nd World War and finally since the end of the latter.

Cold chain and air-conditioning in the Sahara. M. ZHENDRE, *Ateliers de Constructions Zhendre, Bordeaux-Begles (France)*. The beginning of oil-prospecting in the centre of French Sahara in 1953 raised serious problems for users and for manufacturers of refrigerating equipment. All techniques used up to now appeared inadequate and new ones had to be found. In 1958, with the development of oil-prospecting camps, the manufacture of big insulated or refrigerated containers up to 50 m.³ made possible the transport "from door to door" by road and tracks over 1,500 km. under the worst conditions. Finally, especially strong air-conditioners operating up to +60° C., enable prospectors to alleviate the severity of Saharian climate.

Mechanically refrigerated transport vehicles **Comparisons of various types of cooling equipment**

Latest development of mechanical railroad refrigerator cars in U.S.A. T. M. ELFVING, *Burlingame, California (U.S.A.)*. The period of experimentation is over, mechanical refrigerator

cars are now being built in large series of up to 1,000 cars. The conversion to mechanical refrigeration from ice bunker cars will in the next few years be accelerated.

Experience in operating mechanically refrigerated railway trains in the U.S.S.R. S. N. KOBLOUSHVILI, *VNIKhI, M. S. MARTINOV, Ministry of Railways of the U.S.S.R.*, and M. M. SHAPOVALENKO, *U.S.S.R. Scientific Research Institute of the Railway Transportation, Moscow (U.S.S.R.)*. The transportation of perishables in the U.S.S.R. is characterized by long delivery distances. During the autumn and winter periods a considerable amount of foods is transported in heated cars. During 1959-65 it is planned to considerably increase the stock of mechanically refrigerated cars.

Railway car for frozen goods with mechanical refrigeration as well as cold accumulating plates. P. O. PERSSON, *Helsingborgs Fryshus Aktiebolag, Stockholm (Sweden)*. Apart from a short description of the construction and insulation of the car itself the installed freezing equipment and capacity of the cold accumulating plates are also described. In the address information is further given on laboratory tests as well as operating tests of the new car.

Comparison of cost price of transport in refrigerated and mechanically refrigerated road vehicles. P. CLEMENT, *S.E.T.I.F., Paris (France)*. The A. first describes the composition of the rolling-stock of insulated, refrigerated and mechanically refrigerated road vehicles, designed according to French regulations and permitted to operate.

Particular features of refrigerated transport of some perishable foodstuffs

Providing specific transit environments consistent with commodity and market requirements. A. L. RYALL, *U.S. Department of Agriculture, Beltsville, Md. (U.S.A.)*. Optimum temperatures for transporting various fruits and vegetables vary widely according to perishability, sensitivity to low temperatures and need for special conditioning such as wound healing or initiation of ripening. For transit purposes horticultural commodities fall into five groups. All of these groups could be accommodated with proper mechanical cooling and heating units, but most of the rail cars and many of the truck carriers in U.S.A. are now ice refrigerated.

Observations on the transport of precooled soft fruits in the United Kingdom. W. H. SMITH, *Dutton Laboratory, D.S.I.R., Maidstone, Kent (United-Kingdom)*. During the past few years ways and means of improving the condition of soft fruits at their market destination and during subsequent retail distribution have been explored. Solid carbon dioxide provided a small amount of refrigeration in transit, but it was desirable to have the fruit warm up slowly to a temperature of 10° C. if excessive condensation was to be avoided on arrival at market destination.

On experimental railway transportation of fresh fish using dry ice to keep freshness. N. KUROSE and Y. HASEGAWA, *Japanese National Railways*. A test was made recently by the Japanese National Railways on the railway transportation of fresh fish using refrigerator-cars loaded with dry ice and water ice for the purpose of preventing the surface of fresh fish from oxidation and of subduing the multiplication of putrefying bacilli on the skin of fish, utilizing the carbon dioxide sublimating out of the dry ice.

Changes in weight of frozen meat on removal from cold store. W. BYSZEWSKI, *Warszawa (Poland)*. On removal from freezing and cold storage, frozen meat becomes covered with frost, resulting in an increase in weight. As the occurrence and disappearance of frost take place during the delivery of meat, its weight may change. It is not sufficient to observe only the principal technological conditions during the storage of frozen meat, but also to attempt to restrict every outside deleterious influence and to consider not only the weight, but also the number of units.

Refrigeration problems raised by the transport of perishable foodstuffs by air

Conditions for use of aeroplanes for the transport of perishable foodstuffs. M. MAURER. *Institut du Transport Aerien, Paris (France)*. Experience has shown that in almost all circumstances air transport keeps perishable cargoes within the range of temperatures required by their storage, without insulation and air-conditioning of the holds. Under some rather rare conditions, and when the circulation of outside air in flight is not sufficient, the holds must be cooled before loading, which may be done either by means of movable air-conditioners (various constructors made special devices to this purpose), or, if a cold room is installed in the airport, by means of the refrigerating machinery of the latter. The insulation of the body is rarely required.

Cooling of aircraft holds at ground. M. MAURER. *Institut du Transport Aerien, Paris (France)*. The A. studies in detail the problems of the cooling of aircraft holds at ground, which is secured either by special movable equipment, or possibly, when a cold store is installed at the airport, by the refrigerating machines of the store.

Equipment of aircraft for the transport of perishables foodstuffs under controlled temperature. M. MAURER. *Institut du Transport Aerien, Paris (France)*. The A. describes the principles of operation of air-conditioners, and some types of apparatus used. He finally gives some details on thermal insulation for aircraft holds.

Air cargo refrigeration in the U.S.A. W. H. REDT. *U.S. Dept. of Agriculture, Beltsville, Maryland (U.S.A.)*. Air movement of perishables in the United States is performed by air cargo lines and regular passenger airlines. Refrigeration is highly essential during ground handling which includes pickup and delivery from the airport. Various methods of package refrigeration are used including water ice, proprietary refrigerants and dry ice (solid CO₂). Insulating blankets are frequently used to aid in maintaining temperatures. No aircraft cargo compartments are presently equipped with refrigerating equipment.

Testing methods for refrigerated transport equipment

Notes on the testing of insulated, refrigerated and mechanically refrigerated vehicles. M. ALTIERI. *Experimental Institute of Italian Railways, Roma (Italy)*. The measurement of the coefficient of heat transfer (K) through the walls of heat insulated vehicles can be made by using either the method of inside heating or the method of inside cooling. Since there are very often heat leakages through the body of the vehicles, it would be advantageous to measure leak sections. A device designed for this measurement is mentioned, which gives very useful, though not perfectly accurate, data.

Heat sink method for measuring the cooling load of a refrigerated structure. P. R. ACHENBACH and C. W. PHILLIPS. *National Bureau of Standards, Washington (U.S.A.)*. A simple and accurate method is described for measuring the cooling load of a refrigerated structure with the temperature and humidity gradient through the walls in the same direction and of the same magnitude as in normal use.

The effect of solar radiation in transport under controlled temperature. M. ALTIERI. *Experimental Institute of Italian Railways, Roma (Italy)*. A simple method for the estimation of the effect of solar radiation on transport by rail under controlled temperature is suggested by the A.

A non-steady-state method for measuring K-value of insulated transport vehicles. P. NOORDZIJ. *Institute for Research on Storage and Processing of Horticultural Produce, Wageningen (Netherlands)*. Heat transfer coefficients and accumulation of heat were determined in two different ways. Determination according to the non-steady-state method agreed quite well to results of the commonly used method.

Use of "eutectic ice" in railway refrigerator cars. C. P. LENTZ. Tests comparing temperatures in crushed frozen sodium chloride brine of eutectic strength with those in a eutectic mixture of crushed ice and salt under a range of conditions comparable to those in railway refrigerator car ice tanks indicated that the use of the "eutectic ice" would lower car temperatures at least 3° F. and give more reliable performance.

The new refrigerated railway cars with electric fans of the Interfrigo Co. F. W. EICHHOLTZ. *Interfrigo, Bale (Switzerland)*. In 1957-8, the international company for refrigerated transport by rail Interfrigo, put into service 290 refrigerator cars of standard type UIC-ORE 1 with average ordinary thickness of insulation and electric air circulation. In addition, some European railway companies have also bought or ordered a number of vehicles of the same type, so that within two years, about 1,500 units of this type will be operated on the European system.

The effect of conduction heat flow in gaseous phase on the insulating capacity of insulated refrigerated and mechanically refrigerated vehicles. Methods recommended for tests. V. IDL. *Research Institute of Machinery for Refrigerating and Food Industries, Praha (Czechoslovakia)*. A paper presented at the last meeting of commission 7 discussed the importance of the heat flow which, due to pressure differences, passes through walls permeable to air, in continuous operation. The present paper deals with measuring methods for heat leakages due to conduction in the gaseous phase through various insulating materials used in the construction of insulated, refrigerated and mechanically refrigerated vehicles.

Experiments on the operation of a series of mechanically refrigerated railway-cars and respective conclusions. V. IDL. *Research Institute of Machinery for Refrigerating and Food Industries, Praha (Czechoslovakia)*. In 1949, some mechanically refrigerated railway-cars for the transport of frozen and cooled foodstuffs were constructed. It was then one of the first import- and achievements of mechanical refrigeration in the field of transport by rail. The paper reviews some details of the structural developments in this series.

COMMISSION VIII

REFRIGERATED TRANSPORT BY WATER

Insulation of Ships

Insulation of ships. L. L. WESTLING. *Oakland, California (U.S.A.)*. There have been two eras in the subject field as related to materials and methods of their installation. Era one was associated with the principal basic insulator cork in its various forms. Era two employed cork-substitutes, the principal ones being fibrous forms of fibreglass and mineral wool. We are on the threshold of era three which will be marked by the use of polystyrene and urethane foams. The properties of the ideal ship insulator are listed.

The insulation of ships holds. E. BRENDENG. *Norges Tekniske Høgskole, Trondheim (Norway)*. Previous investigations reported before the I.I.R. have stressed the importance of forced convection in ships insulations. At the commission 8 meeting in Nantes in 1956, a method to avoid forced convection by separating all coolers and air ducts from the insulation lining by a "cofferdam" was suggested. Since then this system has been applied in the construction of a number of refrigerated ships. Complete balance tests have been carried out on one of these vessels.

Technique of installation of inner linings in cold rooms on board ship. M. BERNIER (France) The A. enumerates the conventional techniques for the installation of inner linings in cold rooms and mentions some alternatives and surveys the economy of the process.

Disposable insulation and portable refrigeration for orange cargoes. C. E. B. COOPER. *Perishable Products Export Control Board, Cape Town (South-Africa)*. Precooled oranges shipped in past years under ventilated conditions in uninsulated spaces were exposed to maximum temperatures of between 80° and 90° F.; unsound fruit became wasty and there was a loss of appearance, weight and condition. Tests using temporary felt insulation were unsuccessful in 1954. Research in insulating materials have shown possibility of using disposable aluminium foils with latex adhesives.

Results of balance tests on insulated domestic chambers. G. LAING. *Miller Insulation and Engineering Ltd., Glasgow (United-Kingdom)*. The results of heat balance tests on a variety of types of refrigerated cargo ships with special reference to the type of insulation material and lining are discussed.

Note on some measurements made on board ship in relation to the conductivity of some insulating materials. G. E. MERLIN, *Compagnie Generale Transatlantique*. LIEBAULT, *Societe Roclain et DUBREUIL. Societe Fibriver, Paris (France)*. The note gives account of some measurements of the *K* coefficient of heat transmission of the insulation material made under identical conditions by means of heat meters and thermocouples, on board three banana ships insulated respectively with rock wool, glass fibre, and granulated cork.

Report of measurements made to estimate the effect of solar radiation on the heat transferred to accommodation on board ships. P. BARRILLON. *Institut de Recherches de la Construction Navale, Paris (France)*. The "Institut de Recherches de la Construction Navale" made in the summer of 1958 measurements aiming to determine the effect of solar radiation on the heat flux entering an outer cabin under a weather deck. These tests carried out at equilibrium included the simultaneous measurement of heat fluxes from the sun, of fluxes passing through the structures and of the temperatures of air and of these structures.

Refrigerating equipment on board ships

Application of refrigeration in ships. L. L. WESTLING. *Oakland, California (U.S.A.)*. The well-demonstrated, two-temperature brine plant provides near-ideal conditions for both frozen and unfrozen cargoes. Recent betterments in design of brine systems have been developed by the A. and are outlined.

Principles of refrigerated cargo hold design and their control. S. R. SUNTUR. *Turkish Maritime Bank, Istanbul (Turkey)*. The author's experience has shown that in practice most naval architects are primarily interested in the payload and neglect important thermodynamical and mechanical refrigerating principles at least as important as the insulation factor in their refrigerated room designs. He believes that the design of the ship's refrigerated room should take careful note of three essential parts, which are: (1) location; (2) construction; (3) installation.

The application of automatic temperature control to refrigerated spaces in ships. J. H. DANAGHER. *Drayton Regulator and Instrument Company Ltd., West Drayton, Middlesex (United Kingdom)*. The methods of applying automatic control are fully described and particular reference is made to the selection of the most suitable equipment to be employed for each application bearing in mind the produce being carried.

Investigation into airflow systems of refrigerated cargo holds. O. PRINZING. *Hamburg (Germany)*. Air circulation in refrigerated cargo holds by means of horizontal and vertical airflow has already been investigated in 1930 by Ditton Research Laboratory. A team of workers founded by the A. has continued these investigations and extended them especially to aerodynamic conditions in air coolers, fans and airducts.

Carriage of fruit cargoes

Comparison of two systems of air circulation for cooling bananas on banana-ships. R. DEULLIN. *Institut Francais de Recherches Fruitières, Paris (France)*.

Studies about the cooling down of bunches of bananas wrapped in polythene film on a banana-ship using vertical air circulation. E. MERLIN. *Compagnie Generale Transatlantique, Le Havre (France)*.

Contribution to the study of the cooling of banana clusters. A. GAC. *Centre de Recherches et d'Experimentation de Genie Rural, Antony (France)*. The A. describes an apparatus constructed at the "Centre de Recherches et d'Experimentation du Genie Rural," Antony, France, for the study of the cooling of banana clusters. The apparatus is an insulated locker with an effective inner volume of 4.5 m³ simulating a unit of a banana cargo-boat hold with downward vertical air-circulation.

Carriage of oranges in ship spaces using temporary insulation and portable refrigeration. W. W. BOYES. *Perishable Products Export Control Board, Cape Town (South Africa)*. Due to shortage of refrigerated shipping space, oranges have on occasions to be shipped under ventilated non-refrigerated conditions with consequent poor arrival on overseas markets. In an effort to improve the position, oranges were carried in uninsulated ship spaces using temporary insulation and portable refrigeration and the outcome of these oranges was compared to that of comparable samples carried both under refrigeration at 40° F. and under ventilated non-refrigerated conditions.

Recent Australian trends in the packaging of apples for sea transport to the United Kingdom. S. A. DE BEAUX. *(Australia)*. Investigations have been made in recent years into the transport of apples from Australia in cell pack cartons, and master containers designed to hold 24 or 25 bushels of fruit.

Irreversible damage done to deciduous fruits by exposure to temperatures of 24° and 26° F. prior to storage at 31° F. W. W. BOYES, *Perishable Products Export Control Board* and L. GINSBURG, *Western Province Fruit Research Station, Cape Town (South-Africa)*. Various varieties of apricots, peaches, plums, grapes and pears which had previously been cooled to 31° F., were exposed to temperatures of 24° F. and 26° F. for periods ranging from 8 to 144 hours to determine whether any irreversible damage had been done if subsequently stored at 31° F. It was found that apricots, peaches and plums were relatively sensitive to the sub-freezing temperature and irreversible damage was found in samples exposed for periods of 12 hours or longer.

Air-conditioning of passenger and crew accommodation on ships

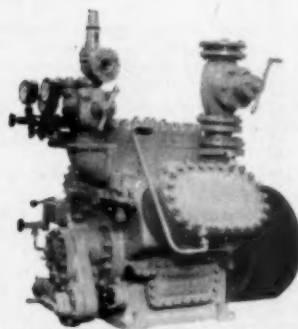
The human factors influence on future marine air-conditioning. S. CLEMMESSEN, B. ISEN, *Kommunehospitalet*, and G. WERNER, *GW Ventilation A/S, Copenhagen (Denmark)*. A short, clear summary of the various communications of interest on this subject, given at the international meeting at Nantes 1957, where these problems were discussed mostly on a traditional basis it seemed evident that many are in search of new ways and means to achieve new goals on the subject, but no precise indication seems yet to have been given as how to plan future research. The authors' research plan is planned as a basis for Danish teamwork with the object of reaching a wider understanding and a more precise definition on "The human comfort" in modern indoor climate.

A comparative analysis of three systems of marine air-conditioning. B. HICKMOTT. *Newcastle upon Tyne (United-Kingdom)*. Many naval architects and marine superintendents as well as ship owners are now having to decide on alternative types of systems for accommodation air-conditioning and it is felt by the author that a technical appreciation of three basic systems, prepared for an identical section of a standard ship accommodation, would help in indicating some of the advantages and disadvantages of the various systems.

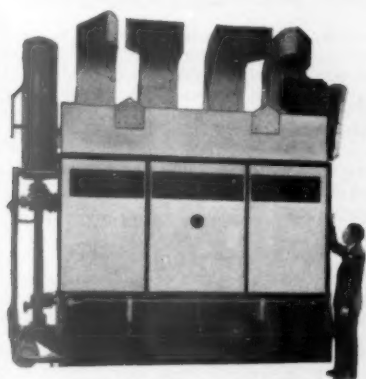
Cooling of cargo ship accommodation. An estimate of the annual hours of operation in different services. N. NORGGAARD-NIELSEN. *Nordisk Ventilator, Naestved (Denmark)*. By means



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of lines superimposed on a map of the world, on the basis of an investigation into temperature conditions at a large number of coastal stations and monthly isotherms for the oceans, the requirement for cooling of ship's accommodation can be computed.

Cooling of cargo ship accommodation. Initial and operational cost. N. NORGAARD-NIELSEN. *Nordisk Ventilator, Naestved (Denmark)*. Based on experience gained in the projection of plants for more than 1,000 ships the lecture gives an estimate of the extra cost arising out of the installation of air-conditioning plants in cargo vessels instead of plants for heating and ventilation only.

Refrigeration as applied to fishing boats

Refrigerating equipment on the vessels of the U.S.S.R. fisheries industries. E. G. PAVLOV and R. V. PAVLOV. *Moscow (U.S.S.R.)*. The paper deals with problems of refrigeration on board ships of the U.S.S.R. fisheries industry including vessels in commission, being designed, and under construction.

A fish freezing installation for British distant water trawlers. M. B. F. RANKEN. *J. and E. Hall Ltd., Dartford, Kent (United Kingdom)*. The present position in the British fishing industry is summarized and it is argued that the part-freezer trawler is a better proposition for the immediate future than the factory trawler or mother ship. The Torry-Hall vertical plate freezer is described in some detail.

Refrigerating equipment installed in auxiliary factory ship s.s. "Enderby." J. A. BREWSTER and B. A. PHILLIMORE. *London (United Kingdom)*. The fitting of refrigerating equipment to the s.s. *Enderby* for the purpose of freezing whale meat or other products is described. The vessel has a freezing capacity to deal with 180 tons per 24 hours of warm meat, to be frozen, packaged and stowed in holds and to be maintained not higher than 10° F. The time the meat is held in the specially designed freezing machines is not more than four hours for a frozen block of 110 lb.

Freezing plant for whale meat and liver on board ships. E. HOFFMANN. *Gesellschaft für Linde's Eischmichen Aktiengesellschaft, Wiesbaden (Germany)*. Special semi-automatic apparatuses have been recently constructed for freezing whale meat on board whalers. The meat is cut and washed with sea-water. It is put in moulds made of vertical central hollow plates with movable plates on both sides, in which cold brine is circulated during freezing time and hot brine during thawing time.

COMMISSION IX EDUCATION

General review of the teaching of refrigeration for the middle and low level in Western Germany and the equipment of a refrigeration laboratory for this purpose at the Staatstechnikum Karlsruhe. V. FUNER. *Staatstechnikum, Karlsruhe (Germany)*. The A. gives the further development in this field of teaching of refrigeration for the middle and low level since his report to commission 9 in Baden-Baden in September 1953 and describes the newly-established refrigeration laboratory at Staatstechnikum Karlsruhe.

The aim of the education of refrigeration service-men and fitters. N. C. TOFTEGAARD. *Danish Refrigeration Research Institut, Copenhagen (Denmark)*. It may be considered to be a matter of importance that the running of the various kinds of refrigeration plants are faultless. Therefore precautions are taken to ensure this. First of all the experiences of the manufacturers of refrigeration machinery and devices for automatic control carry weight. Besides that, in Denmark as well as in many other countries, safety codes are published in order to lower the hazards concerning the construction, maintenance and running of the refrigeration plants.

Report on technical training of workers for scientific research. J. MORENO CALVO. *Centro Experimental del Frio, Madrid (Spain)*. Mental power and gift of experimental observation

may be progressively developed in scholars or beginners, of average ability and vocation, with suitable direction, guidance, stimulus, etc., to obtain skilled specialists, of high standard, or reliable enough to co-operate in real team research, under the direction of a head conscious of his mission.

Some aspects of biological research and of training in refrigeration. J. MORENO CALVO. *Centro Experimental del Frio, Madrid (Spain)*. Though this subject does not seem to have been dealt with in a general study, the aspects of biological research and of training in refrigeration are investigated, as well as their methods and instruments, their scientific importance and their value in their specific field at present time.

Extension in non-industrialised countries. T. VAN HIELE. *Institute for Research on Storage and Processing of Horticultural Produce, Wageningen (Netherlands)*. The application of refrigeration in countries which do not use refrigeration in the measure they should, is in need of extension on behalf of the user and the supplier of the refrigerating equipment. The government involved is also served by getting information as to how an extension service should run. In order to get an extension service working as well as for the information of the government it is necessary to organize extension, research and education. This demands the collaboration of the future user of refrigeration, the refrigeration equipment trade and those interested in the cold chain.

The popularization of refrigeration in French rural spheres. M. ANQUEZ and B. TIERSONNIER. *Ministere de l'Agriculture, Paris (France)*. The concept of refrigeration and its possible usefulness in farms is still not well known in France. Since 1956 a campaign of information about the applications of refrigeration in farms is made every year in a French region grouping five or six "departments."

A new design of psychrometric charts for use in calculating air coolers. S. A. ANDERSEN and N. C. TOFTEGAARD. *Køleteknisk Forskningsinstitut, Copenhagen (Denmark)*. As is well known, two types of psychrometric charts are in general use, viz. the so-called Mollier-diagram and the t_x -diagram, which some of us term the Carrier-diagram in honour of the late American scientist and industrialist Wm. Carrier. Whereas the Mollier-diagram yields correct results of the calculations, when the conditions in the different points of a process are read, the latter type needs corrections of different kinds, cf. the A.S.R.E. Data-Book, etc. In this paper is discussed the design of a diagram by use of which most of the corrections are made unnecessary.

Comments on the numerical designation of fluorochloro compounds of hydrocarbons. J. MORENO CALVO. *Centro Experimental del Frio, Madrid (Spain)*. Possible advantages and disadvantages of adoption and future application of various nomenclature systems for refrigerants widely used in the refrigeration industry.

(conclusion)

The first ARI Standard for refrigeration units designed for use in refrigerating trucks and trailers has just been published by the Air-Conditioning and Refrigeration Institute, U.S.A. In process of preparation for almost two years, the new publication is numbered ARI Standard 1110-59, and is fully titled "ARI standard for speed-governed transport refrigeration units employing forced-circulation air-coolers." A speed-governed unit is defined as a unit whose drive is designed to operate at a governed (constant), although possibly adjustable, speed. Work on a second equipment standard, covering hydraulic-drive and other types of variable-speed units, as well as on an application standard to relate the standard ratings and other performance characteristics of both types of units to a certification programme, will start immediately, according to ARI Chief Engineer Frederick J. Reed. Upon completion of these standards, it is hoped that a certification programme may be initiated by ARI's mobile air-conditioning and refrigeration section.

National Federation of Cold Storage and Ice Trades—

ANNUAL LUNCHEON

At the annual luncheon of The National Federation of Cold Storage and Ice Trades held on the 1st instant at The Criterion, London, Mr. Eugene Ruddin, C.B.E., president (third from right), took the chair and was supported by Mr. Kenneth Lightfoot, O.B.E., past-president (second from left), and Mr. F. S. Beckett, member of council (extreme right). Chief guests were Sir Henry S. E. Turner (third from left) and Mr. J. R. Parratt (second from right). (Points from speeches next month).



BUILT-IN REFRIGERATOR



Featured on the Electrolux stand at this year's Building Exhibition (Olympia, November 18—December 2) will be the popular M.27 built-in refrigerator. Designed to be built in at any convenient height—at waist level or floor level—it

saves valuable floor space and has 5½ sq. ft. of shelf area and an internal volume of 2½ c.ft. The Electrolux model M.27 is available in cream or white for operation by either electricity or gas and it can be supplied with a left or right hand opening door. The M.27 has a vitreous enamelled interior lining with hygienic plastic facings and an inner door panel. Its three internal shelves include one with a hinged flap for the storage of tall bottles. In the door are two removable shelves and covered butter and cheese compartments. The ice compartment is fitted with a 14 cube quick-release tray.

Being a fixture, a built-in refrigerator can, in most cases, be included in a mortgage and Electrolux built-in models are being demanded by large numbers of builders, and by local authorities who offer them to tenants on a simple hire basis included within the weekly rent. Installation is easy. The cabinet, height : 34 11/16 in., width : 22½ in., depth (excluding door and fittings) 23½ in., slides into a prepared recess. The price is £53 10s. 4d.

Ice Factories for Thailand

Grasso's Koninklijke Machinefabrieken N.V., at 's-Hertogenbosch, Holland, has obtained an order for the supply of eight ice factories to Thailand. This country plans to build a weir with the assistance of funds from the Development Loan Fund. In order to execute the project, it requires ice factories for supplying the fine crushed ice used to keep concrete cool during hardening. Since there is a great demand for block-ice in tropical countries, plants were sought which could produce crushed ice during the construction of the weir and block-ice afterwards. Grasso's fully automatic ice generators were especially suitable for this purpose because, by the turn of a switch, crushed or block-ice can be produced as required. So, after the weir in Thailand is completed, the country will have eight ice factories each with a capacity of over 15 tons of block-ice per 24 hours. The first ice-factory will be shipped to Thailand before the end of the year.



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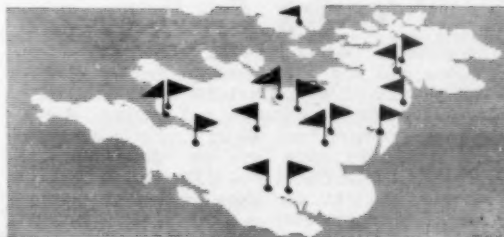
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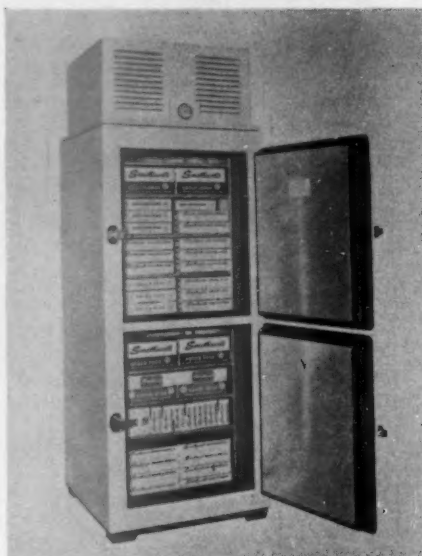
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TA/257J

NEW "ZERO-STORE"



Built to give maximum storage space while occupying minimum floor area, the "Zero-Store" stands 6 ft. 3 in. high with a base measurement of only 2 ft. 7 in. by 2 ft. 9 in., and will hold at least 500 lb. of packaged frozen foods at 0° to -5° F. in ambient temperatures of up to 90° F. The introduction into their range of commercial refrigeration products of this new vertical frozen food storage cabinet has been announced this month by Frigidaire Division of General Motors Ltd.

Freezing Poultry

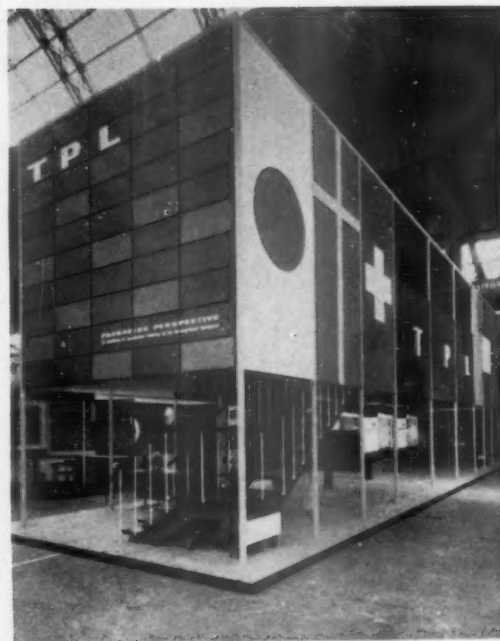
The great increase in the demand for broilers for spit roasting and for frying and the greater demand for table poultry of all kinds have brought home to packers the necessity for adequate, fast freezing. Refrigeration engineers have been telling their customers and potential clients for some time that slow freezing is really worse than no freezing at all because it destroys the flavour of the birds and gives the flesh that brown tinge which is anathema both to poulterer and consumer. An answer to the packers' problem is to be seen at a mid-Suffolk poultry packing station operated by J. W. Diaper & Son of New Street, Haughley. An old lath and plaster barn has been completely rebuilt to house a blast freezer and to provide both a chill room and a sub-zero storage room. A new concrete floor has been floated and the walls have been insulated with eight inches of cork and the ceiling with Polystyrene; a "super-freeze" door has also been fitted. In the chill room the poultry is brought down to a temperature of 35° F. which is maintained for about four hours; an air cool condenser unit with a 3 h.p. motor provides the necessary cooling means. In the sub-zero chamber, which has a capacity of 4,000 cu. ft., which means space for fifty tons of poultry, a cooler arranged

for water de-frosting is operated by a compressor unit with 10 h.p. motor. The freezing air which is at -22° F. (52° of frost) is maintained by two fifteen inch axial-flow fans running at 2,800 rev. per minute. The poultry is stacked in this room in cardboard boxes and three hundred birds can be dealt with every two and a half hours. Advice about the installation was given by Mr. L. E. Cozens of the Eastern Electricity Board, who were also responsible for the installation.

Decreased Meat Shipments

During 1958 shipments of chilled and frozen meat from Argentina and Uruguay to this country amounted to 315,000 tons a decrease of 35,000 tons on the previous year. The proportion of chilled to frozen meat continues to increase, said the R.M.L. chairman. The reduction in the quantity of meat exported to this country may be attributed to a variety of causes, chief among which were the serious labour difficulties experienced in Argentina, flood conditions and shortage of stock. It is to be hoped that the steps being taken by the Administration will eventually enable exports to be increased.

T.P.L.'s STRIKING STAND



Transparent Paper Limited's exhibit at the Packaging Exhibition, Olympia, London. Based on a three-tier principle, the exhibit, covering an area of over 2,000 sq. ft., rose to a height of 21 ft. Featured in a 29-ft.-long mahogany and sycamore showcase on the ground floor it was the specially commissioned work of six leading international designers.

heat-X

WATER CHILLERS

are now
available
up to

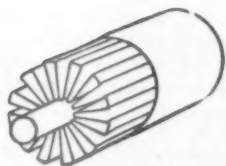
100
TONS
CAPACITY



To be able to achieve a capacity of 100 tons within the extreme compactness of a Heat-X Chiller is a tribute to the efficiency of the patented inner-fin construction. This clever design is one of the unique features which make Dunham-Bush Shell and Tube Chillers the smallest big-performance chillers on the market.

Heat-X CH inner-fin water Chillers range from 2 to 100 tons capacity. With non-ferrous water passages throughout there are no corrosion problems and single pass construction prevents oil-trapping.

Details of construction, specification and dimensions are available. Please write for Bulletin HX/1001A.



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HEATING AND COOLING

The Institute of Refrigeration Bulletin

Institute Headquarters: New Bridge Street House, New Bridge Street, London, E.C.4. (CENTRAL 4694)

Sessional Programme 1959-60

The following programme has been arranged for the forthcoming session :

October 22, 1959.—A symposium on the Tenth International Congress of Refrigeration.

December 3, 1959.—“The use of refrigeration in butchers' shops” by F. R. I. Gerrard, M.B.E., Member, and J. A. Stonebanks, Member (joint meeting with the Institute of Meat).

January 7, 1960.—“Some lubricating problems of refrigerating machines using refrigerant-12” by H. Heckmatt, B.Sc., Associate Member.

January 27, 1960.—Annual Dinner at the Savoy Hotel, London, W.C.2.

February 4, 1960.—“Polyurethane foams: their contribution to heat insulation” by J. M. Buist, B.Sc., and R. Hurd, B.Sc.

March 3, 1960.—“European refrigerated transport by railway” by Dr. E. Baumgartner.

March 16, 1960.—A symposium on “Construction of cold stores for fruit” (an all-day meeting at Dittón Laboratory).

April 7, 1960.—“Some problems associated with the use of a high speed reciprocating compressor for aircraft cooling projects” by J. D. Gurney, B.Sc., Associate Member. (joint meeting with the Low Temperature Group of the Physical Society)

May 5, 1960.—“The demand for cooling in the modern passenger liner” by A. J. Barnard, B.Sc., Ph.D., and S. J. Jones, B.Sc., Associate Member (joint meeting with the Institution of Heating and Ventilating Engineers).

Unless otherwise stated, all the above meetings will be held at The Institute of Marine Engineers, The Memorial Building, 76 Mark Lane, London, E.C.3, at 5.30 p.m. Tea will be served at 5 p.m.

OCTOBER MEETING

At the meeting of the Institute to be held in the Memorial Building of the Institute of Marine Engineers, 76 Mark Lane, London, E.C.3, on Thursday, October 22, 1959, at 5.30 p.m., there will be a symposium on the Tenth International Congress of Refrigeration.

Mr. W. B. Gosney, B.Sc., member, will talk about the engineering papers presented to the congress, Dr. J. C. Fidler, O.B.E., B.Sc., member will deal with applications to foodstuffs and Mr. K. C. Hales, M.A., member, will speak on refrigerated transport.

PLASTIC INDUSTRY STUDY TOUR

A SPECIAL study tour for executives of the plastics and chemical industries has been arranged in conjunction with the 27th Exposition of the Chemical Industries, November, 1959, in New York.

The tour, which leaves London on Saturday, November 28, 1959, and returns to this country on Sunday, December 13, 1959, includes visits to some of the leading industrial concerns in the United States, and these include Lunn Laminates Inc., Shell Oil Company, the Commercial Plastics and Supply Corporation, F. J. Stokes Corporation, and Dupont de Nemours. In addition, the Hercules Powder Company and Haveg Industries are in the itinerary, as well as Allied Chemicals, Farrel-Birmingham and General Electric also the Monsanto Chemical Company. After visiting the Foster Grant Company at Springfield, the tour will return to Boston, where a visit to the Lowell Technological Institute, the leading college for plastics engineering, has been arranged.

The price of the tour will range from £355 to approximately £500, according to the class of travel and hotel. Full details of the tour may be obtained from Ashton & Mitchell Travel Ltd., 166, Piccadilly, London, W.1.

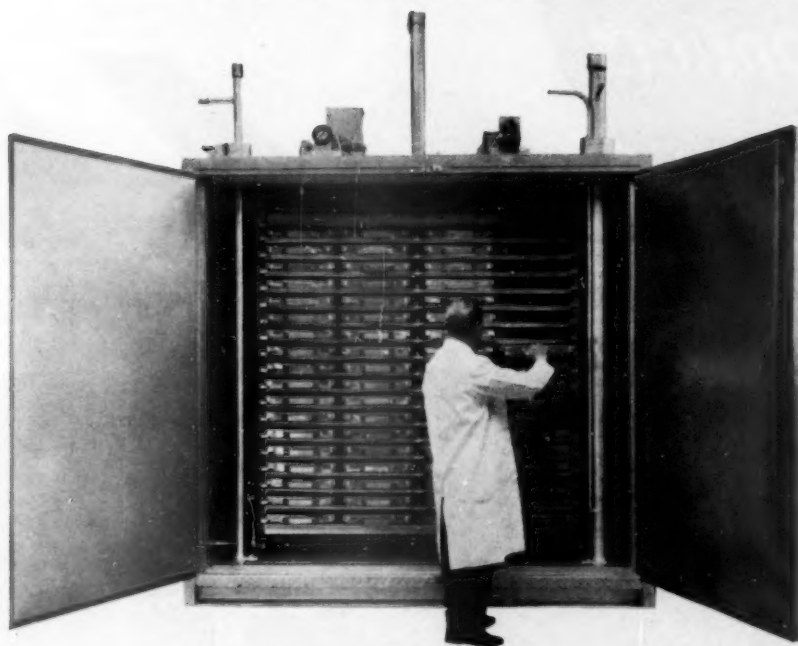
The Board of Trade has been informed by the British Embassy at Tehran that H. E. Mr. Said Mehdi Pirasteh, the new governor-general of Fars, had told them that he had decided to set up an association, either of Shiraz land-owners or of wealthy Tehran businessmen for the collection, sorting, packing and distribution of fruit, meat and vegetables and in this connexion he wishes to get in touch with United Kingdom manufacturers of refrigeration machinery. Manufacturers interested in this enquiry should write direct to H. E. Mr. Said Mehdi Pirasteh, residence of the governor-general, Shiraz, Iran. It would be appreciated if, at the same time they would notify the commercial section, British Embassy, Avenue Ferdowsi, Tehran, that they have done so.

The supply and installation of an air-conditioning system for the rooms of the first floor of the building of Station “C” of Lourenco Marques have been called for by the Ports, Railways and Transport Department, Lourenco Marques. A provisional deposit of Esc. 5,000\$00 must be made by tenderers.

A tender from the Government of India, India Supply Mission, 2536 Massachusetts Avenue N.W., Washington 8, D.C.—under the International Co-operation Administration seeks three unit air-conditioners of the window type—with fan and 1½ h.p. motor and thermostatic control. Closing date is November 5. Enquiries should be sent to the Board of Trade.

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DOUBLE CONTACT PLATE FREEZER



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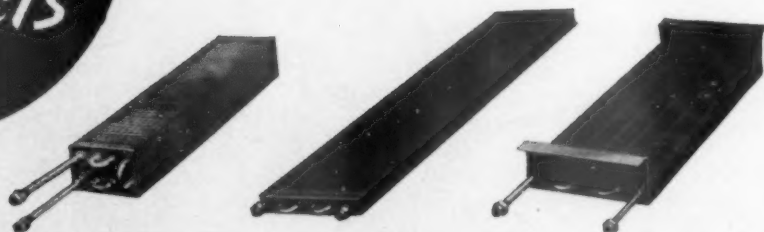
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A NEW *Jackstone* FROSTER

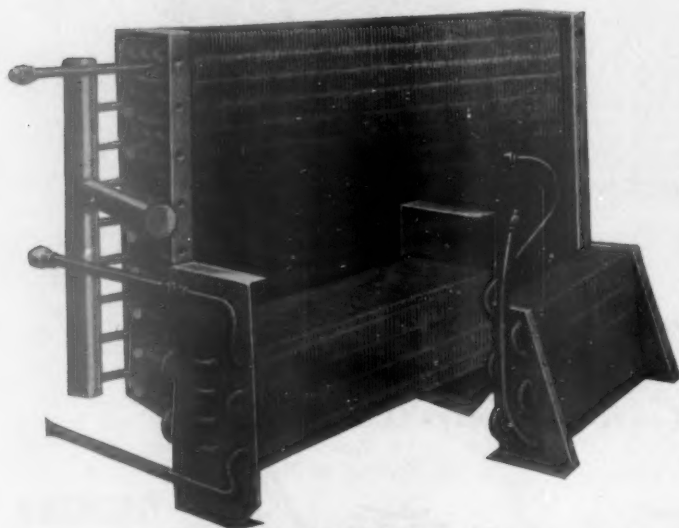


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Commercial and

MANUFACTURERS' AND

Industrial Section

DISTRIBUTORS' NEWS

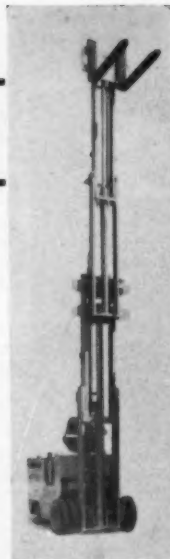
Mr. J. A. Howie, managing director, The Lightfoot Refrigeration Co. Ltd., has accepted the office of first president of The Refrigeration Servicemen's Association.

Mr. V. S. Meadows, M.INST. R., has been appointed a director of Westwick Frosted Products Ltd. He will continue to be responsible for all refrigeration engineering projects and for development.

At a recent meeting of the board of directors Mr. D. C. M. Salt, director of sales, was appointed alternate to Mr. J. W. Urban on the board of Monsanto Chemicals Ltd. Mr. Salt, who joined Monsanto in 1935, has a wide experience and knowledge of the company's selling operations. He was appointed general manager of sales in 1956 and, prior to his recent appointment, was general manager of chemicals division.

Mr. Duncan Welch, sales manager, domestic appliances, of Kelvinator Ltd., has announced the first steps in the company's plans for expanding their domestic sales organization. Mr. D. N. Spanton, formerly midlands regional manager has been transferred to the London office as assistant to Mr. Welch. The midlands regional office at Coventry moved to more spacious premises at 10, Park Road, Coventry, on September 1, 1959. Mr. R. H. W. Rose succeeds Mr. Spanton as midlands regional manager.

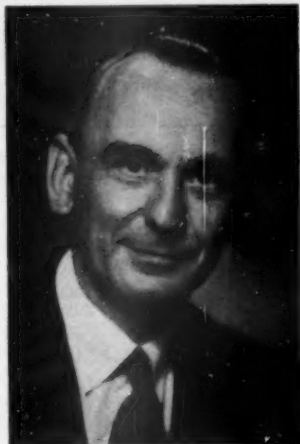
Peter Boyd-Cox has been appointed public relations officer of Electrolux Ltd. The appointment is a new one and Mr. Boyd-Cox will work in close co-operation with the company's publicity manager, Mr. L. J. Donald, at 419 Oxford Street, London, W.1. Mr. Boyd-Cox was formerly with The General Electric Co. Ltd. as press officer of the G.E.C. lighting division and the



(See page 894)

Osram Lamps Division and was editor of the *Osram Bulletin*.

The Lightfoot Refrigeration Co. Ltd. announce the appointment of Mr. P. E. Montagnon, O.B.E., B.A., B.Sc., as manager of their research department. He will be responsible for research into new refrigeration techniques and the application of these and existing techniques and designs to the requirements of the many industries which now use refrigeration and air conditioning.



Mr. P. E. Montagnon.

Mr. Montagnon was, until recently, a deputy chief scientific officer of the Ministry of Power, where he took a particular interest in the uses

of refrigeration equipment. Among other papers he has published he read one on "The economics of heat pumps" at the annual summer convention of the Institution of Heating and Ventilating Engineers at Dublin in 1958.

Pressed Steel Co. Ltd. announce the appointment of Mr. D. A. Field as sales director for the U.K. of their Prestcold division.



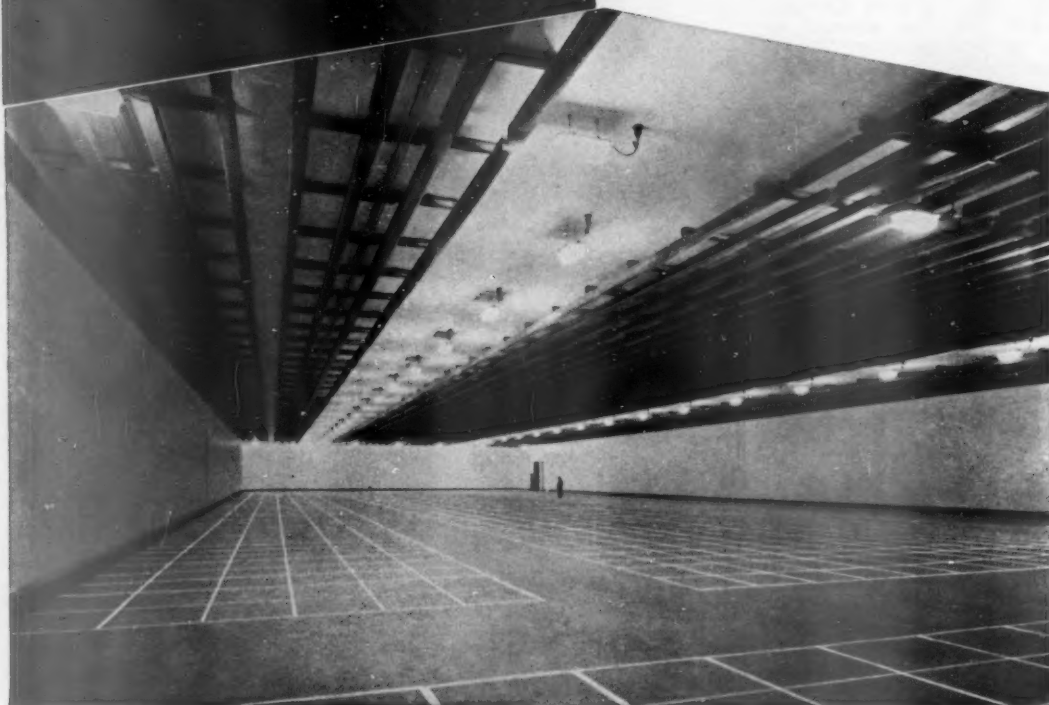
D. A. Field.

Mr. Field's association with the refrigeration industry extends over many years, starting in 1946 when he joined Refrigeration (Birmingham) Ltd., an important organization which held a franchise as Prestcold distributors. He contributed considerably to the development of this firm and became their sales manager in 1949, being appointed a director in 1951 and managing director in the same year. He continued in this latter post when Pressed Steel Co. Ltd. acquired control of Refrigeration (Birmingham) Ltd. in 1958 which was subsequently renamed Prestcold (Midlands) Ltd., a position he will continue to hold in addition to his new responsibilities. In consequence of his active participa-

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Photograph by courtesy of Birds Eye Foods Ltd.

This photograph shows the totally unobstructed interior of a new 580,000 c.ft. cold store for Messrs. Birds Eye Foods Ltd. The single span construction allows maximum storage space and easy handling of the pallets.

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tion in refrigeration sales and distribution over a long period, Mr. Field is very well known to a large number of industrial and commercial firms, retailers in the foodstuffs and allied trades and the electrical trade in general. His new appointment is of particular significance in view of the forthcoming operation of the very large new Prestcold factory in Swansea, South Wales, and the considerable expansion of sales which is envisaged in result.

Mr. David N. Ward has been appointed domestic appliance area manager for **The English Electric Co. Ltd.** in the Eastern Electricity Board area. Mr. Ward first joined the company in 1955 and spent the next two years attached to the domestic appliance division to study all phases of development, production and servicing, as well as working in the central purchasing and publicity offices. In 1957 he was given a roving commission with the division's sales staff, which brought him field experience all over the country. He then joined the Manchester office as a sales representative for the North Western Electricity Board area.

An insulated container built by British Railways for **Birds Eye**



Frozen Foods Ltd. is insulated with 4 in. Onazote all round and has a Rubazote door sealing gasket G. 18C. The container maintains a temperature of 0° F. in an ambient temperature of 70°. It is 8 ft. 3 in. long, 6 ft. 11 in. wide, 5 ft. 9 in. high (internal dimensions), and will carry a maximum load of four tons. It will operate from the Birds Eye factories at Great Yarmouth and Lowestoft.

An overall wage increase to all hourly and weekly paid workers was announced recently by **Frigidaire Division of General Motors Ltd.** The increase, which became effective on the 7th ultimo, will range from approximately 9s. per week for all productive bonus-earning groups, both male and female, to 5d. an hour for tool makers and similar skilled trades. Technical and clerical grades will also receive an increase ranging from 10s. to 15s. a week. Similar adjustments will also be made to the wages paid to junior staff. This decision follows the announcement made last month that the company was reducing the price of most of its commercial refrigeration products by amounts varying between 5 and 10 per cent.

The Insulated Storage and Display Co., have recently issued details of several refrigerated display units. The Marlborough display, which is fan-assisted for temperatures down to 28° F. is priced at £130 net trade, ex works, complete with coil and fans. The Whitney counters, provide an attractive and economical series operated from a rear finned bunker coil. Prices range from the 6 ft. counter top cabinet at £64 to the 10 ft. display and storage at £188. The Hereford display unit is a further example of I.S.D.'s ability to provide for all open display requirements and is priced from £45 for the 4ft. 6 in. model.

Floor space is practically at a premium in every catering establishment, and with this in mind **Lec Refrigeration Ltd.** of Bognor Regis have produced the B.13 bottle cooler. Occupying an area of only 30 in. by 27 in., this 70 in. high refrigerator has a capacity of 13 c.ft., and with its adjustable shelves will store a large number of bottled minerals, beer and fruit juices, and at the same time provide a good supply of ice cubes. Thermostatic chill control maintains correct beverage temperature, whilst automatic interior lighting assists quick and safe handling. It is fitted with a hermetically sealed refrigeration system and powered by the factory installed Lec Vertimetic sealed compressor with an exceptionally low electrical consumption.

Pressed Steel Co. Ltd., announce that the recently established subsidiary company in Brussels, **Pressed**

COMMERCIAL AND INDUSTRIAL

Steel S.A., Cantersteen 7, Galerie Ravenstein 30, Brussels 1., is now in full operation and is represented by: Mr. M. T. Harmsworth, general manager and European representative of the car body division; Mr. J. W. H. Breen, manager; Mr. W. A. F. Boin, European representative of the Prestcold division and Mr. N. Simonis, European representative of the railway division.

Smedley's Dundee canning and quick-freezing factory, normally closed for more than 12 weeks at the end of the fruit and vegetable season, is now to remain open throughout the winter to freeze fish. A new plant is now being installed to handle all Smedley's quick-frozen fish products, which will mean employment for almost 100—more than double the normal winter labour force. The new plant is to be working this month, and will help to meet the increased demand for Smedley's fish products at present handled only at Blairgowrie.

Fish vans being built by British Railways, north-eastern region, are insulated with 2-in. thick **Onazote** on the walls and roof and 1-in. thick **Onazote** on the floor. A total of 250 of these vans are being constructed. British Railways, western region, Swindon, are building 100 insulated containers for **Birds Eye Foods** and these are fitted with 4-in. **Onazote** on walls, roof and floor.

Some six months ago work began on the new Prestcold factory at Jersey Marine, Swansea—a 50 acre building in which it is planned eventually to employ a labour force approaching 3,000 to 4,000 and concentrate beneath one roof the entire production of Prestcold refrigerators and refrigeration equipment. Now—to underline the company's increasing part in the industrial life of Wales—comes the new South Wales branch headquarters, a striking building in the commercial heart of the city of Cardiff. With frontages on City Road and Newport Road, main thoroughfares of the capital, **Prestcold House** conveys the impression of one huge glass wall. This has been achieved by the use of wide windows, behind which is the main showroom in which Prestcold domestic and commercial refrigera-

COMMERCIAL AND INDUSTRIAL

tors will be displayed. Additional space for display has been provided in the form of a combined showroom and entrance hall. Internal décor of Prestcold House is modern in style.



In the showroom the wall facing the window is coloured olive and the other walls sky blue. The flooring is terazzo. The combined display and entrance hall features poppy coloured rear walls and olive for

the other walls. Prestcold House is a two storey building, 120 ft. long by 36 ft. deep, of reinforced concrete clad in brickwork. The total floor area is approximately 8,000 sq. ft. with top floor for office and service store accommodation.

There is a car park at the rear for over 20 vehicles. The architects are Powell & Alport, Cardiff, and the contractors Curran Steels Ltd. The centre was recently opened by The Lord Mayor of Cardiff.

The latest development from Anglo-American Plastics Ltd. (one of the Commercial Plastics Group of Companies) is the polythene film developed for "boil-in-the-bag" applications. Bags made from this special Fablothene film can withstand both freezing and boiling. They are the latest in the range of polythene formulations and follow the current trend for easing the housewife's burden. Food can be pre-packed in this high density polythene film and frozen when fresh. All that is necessary is to immerse the bag complete with contents in boiling water for a specified period of time. When cooked the food is easily removed from the bag into the serving dish and thence to the table. These special Fablothene bags were to be seen on the Commercial Plastics Group stand at the Packaging Exhibition last month.

Two new publications have been introduced by Turner Brothers Asbestos Co. Ltd. One is a comprehensive brochure dealing with all their "Duraglas" glass-fibre products and

the other is a booklet which details their complete range of p.t.f.e. products. Copies of both publications can be obtained from any of their branch offices or from head office, at Rochdale.

The Wallbridge Manufacturing Co. Ltd. last month arranged a demonstration of their fully automatic poultry line at their Supermarine works (the former Vickers factory that produced so many famous planes) at Woolston, Southampton. The demonstration was specially arranged for the French Ministry of Agriculture which was represented by M. Vacherot. With him was M. Meric, President of the Co-operative Movement of S.W. France. The W.L.W. fully automatic equipment humanely kills, clean-plucks and prepares 1,250 birds per hour for refrigeration with the minimum of handling. It is very competitively priced.

The widespread use of plastics in modern life is described in a 12-page illustrated booklet recently pub-

lished by the Distillers Plastics Group. The domestic and industrial applications of synthetic resins and plastics materials are many and varied. The booklet describes some of these uses and underlines the special properties which account for the increasing use of plastics in so many fields.

Information bulletin No. 18 issued by Crane Packing Ltd., describes their types 1A and 2 seals; these are *not* new seals. In fact they were one of the earliest mechanical shaft seals ever to be produced on a commercial basis by Crane. The present versions of their designs incorporate many refinements as compared with the originals; and their present performance reflects the many thousands of hours run in test rigs, and millions of hours in the field. Types 1A and 2 seals are used for services which might broadly be described as general, *i.e.*, for fluids and gases having no more than a slight effect upon the seal's rubber components, and which are being handled at low to medium temperatures and pressures.

The economical collection and delivery of merchandise that takes the form of bulky but light packages continues to be one of the problems of retail selling. A move to cope with it comes from Commer Cars Ltd., the truck division of the Rootes Group, who have introduced a 1-ton van with 280 c.ft. capacity, which by reason of its small turning circle and short wheelbase facilitates manoeuvring in and out of built-up areas and narrow streets.

At a cost of around £250,000 Fibreglass Ltd. have installed one production line—its output is about 50,000,000 c.ft. of insulation a year (although this varies with the density) for the manufacture of "Crown," the name given to a glass fibre of small diameter. Eventually all glass fibre insulation made by this company to this quality will be made by the Crown process.

To obtain extra high stacking while maintaining low headroom requirements at the Crawley, Sussex, factory of Vitamins Ltd., Yale & Towne's British materials handling division has produced a quadruple lift series 51 electric fork truck.

REFRIGERATION ENGINEERS

1881 — 1959

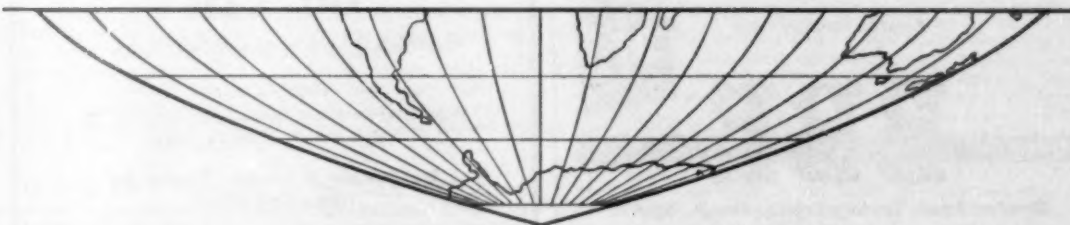
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The truck has an overall height of only 88 in., yet is capable of lifting a load of 1,120 lb. at 27 in. load centre to a height of 228 in. The quadruple lift attachment is based on specifications produced by Yale & Towne's Philadelphia, U.S.A., plant. It consists of a simplex telescopic set of secondary channels which are bolted directly to the primary fork carriage.

The value of Hoover Limited's investment in plant and equipment in the extension to be built at the Hoover (Electric Motors) Limited factory at Cambuslang, Lanarkshire will be in excess of £500,000. This news follows the announcement earlier of an agreement with the Board of Trade for an extension of 88,000 sq. ft. to the existing 162,890 sq. ft. factory at Cambuslang, leased from Scottish Industrial Estates Ltd. When the extension is completed in, it is hoped, 1960, Hoover Ltd. are expected to add 300 employees to the present payroll of 1,450 at Cambuslang.

M. A. Boylan Ltd., the well-known Irish firm of insulation contractors, were responsible for the insulation contract at the new oil refinery at Whitegate, Co. Cork, which was officially opened on September 23. This was the largest insulation contract ever carried out in the Irish Republic. The total

amount insulated was 74,845 ft. or over 12 miles of piping and 50,000 sq. ft. of vessels, towers, etc. The piping was insulated with "Caposite" amosite asbestos sections, finished with an asbestos based felt. The towers, chimney stacks and vessels were insulated with "Rocksil" mattresses and slabs and finished with aluminium sheeting. M. A. Boylan Ltd. are recognized specialists in the

COMMERCIAL AND INDUSTRIAL

cladding of insulation with metal and have in recent years developed their own finishing technique, in particular for large tanks. The Cape Asbestos Co. Ltd. of London, of whom M. A. Boylan Ltd. are a subsidiary, supplied all the insulation materials.



Variety of components produced for domestic industry by Universal Metal Products Ltd.

R.S.A. NEWS

Your committee is now further strengthened with the practical experience and knowledge of Mr. Steggel, service manager, the Lightfoot Refrigeration Co. Ltd., who is now a member. To ensure the furtherance of our educational course, a sub-committee is to be formed to deal with this subject.

Many members unable to attend the Tuesday meetings will be pleased to know of the alteration for next winter's session. As for last winter, the meeting place this winter will be The Junior Institution of Engineers, 14, Rochester Row, Westminster, London, S.W.1, and the time as before, 7.30 p.m. The dates are as follows:—

September 30, 1959, October 28, 1959, November 25, 1959, December 30, 1959, January 27, 1960, February 24, 1960, March 30, 1960, April 27, 1960.

As before, a list of interesting subjects for lectures is being devised for the coming session and adhering to our policy of interesting all members, will cover a wide field.

Among recent memberships are block entries from the staffs of Hays Wharf Ltd., and Gratte Bros. Ltd., both of London. A renewal membership from Mr. J. L. Johnson now in Kuwait and an application from Ceylon show that interest in the R.S.A. has already spread far afield.

The latest survey undertaken by The Board of Trade is concerned with Swiss purchasing organizations, including Government departments, department stores, chain stores and co-operative purchasing organizations, etc. In a survey covering Government departments, large organizations like

Migros and small not very powerful purchasing co-operatives like Sterna, who buy textiles and clothing for 17 retail shops, it is difficult to make generalizations which are true of all the organizations under review. As regards purchasing organizations other than Government departments, these are of varying sizes, handle quite different types of goods and use very different methods. Some like Migros are aggressive, dynamic and very powerful; others are primarily defensive and represent an attempt by small units to defend themselves against the large concerns.

Alboa Engineering Company Limited, 33 Hahashmal Street, Tel Aviv, have informed the British Embassy at Tel Aviv that they are interested in high velocity ducting systems for air-conditioning. It is reported that the ducting can be made locally, but the Tel Aviv firm are interested in importing some of the other components including mixing chambers, outlets and volume controls. Alboa Engineering Company Limited were established in March, 1958, as a partnership between M. Levinson and D. Ben Ezer. Mr. Levinson is the director of Levinson Brothers, Engineers, Limited, a well-known and long established firm dealing in a wide range of electrical and engineering equipment. Mr. Ben Ezer is an electrical engineer with wide experience in the fields of air-conditioning and refrigeration. He is also the technical consultant of a number of large industrial undertakings. The Israeli concern are considered to be a suitable connexion for United Kingdom firms.

NEW COMPANIES

The accompanying particulars of New Companies recently registered are taken from the Daily Register compiled by Messrs. Jorden and Sons Ltd.

Fan Systems (London) Ltd., 211, Deansgate, Manchester, 3. Secretary: A. C. Simkins. To carry on business of heating, ventilating and air-conditioning engineers, etc. Nominal Capital: £1,000. Directors: James R. Murphy, 14, Jenny Lane, Woodford, Ches.; Vere E. Hood, Rockcliff, Bridge of Weir, Renfrewshire; Alfred C. Simkins, William Vaudrey and William Clarke. Registered by Hutton Hartley & Co., Ltd.

Andrews Refrigeration Services Ltd., 10, Prospect Street, Plymouth. Secretary: A. E. Kelland. Nominal Capital: £1,000. Directors: Ernest A. Andrews and Mrs. Barbara D. Andrews, 10, Prospect Street, Plymouth. Registered by Shaw & Sons Ltd.

Liverpool Insulation Co. Ltd., 4AA12, Newstet Road, Kirkby, Liverpool. Secretary: L. Jones. To carry on business of manufacturers and installers of and dealers in refrigerators and refrigeration plant, etc. Nominal Capital: £500. Directors: Thomas W. Bigge, Carleton, Well Lane, Heswell, Ches.; Alan Bramwell, 70, Silverdale Road, Warrington, Lancs. Registered by H. T. Woodrow & Co. Ltd.

Keverley Services Ltd., 123, Grosvenor Road, St. Pauls, Bristol, 2. Secretary: T. J. Bryant. To carry on business of manufacturers of and dealers in television and wireless sets, radiograms, refrigerators, etc. Nominal Capital: £100. Directors: Tony E. Poole, Lynwood Lodge, 625, Bath Road, Brislington, Bristol; Brian D. Toon, 2, Melrose Place, Clifton, Bristol, 8. Registered by Stanley, Dean & Co. Ltd.

Elesca (Domestic Supplies) Ltd., 4, Rock Hill, Mansfield, Notts. Secretary: Marian M. Tribe. Nominal Capital: £2,000. To carry on business of dealers in washers, spin driers, paraffin heaters, refrigerators, etc. Directors: Peter H. Tribe and Marian M. Tribe, 4, Rock Hill, Mansfield, Notts. Solicitors: Marchant & Co., Mansfield. Registered by Jordan & Sons Ltd.

Fro-Pareva Co. Ltd., 2a, Gore Street, Manchester. To carry on business of cold storage and refrigeration engineers, etc. Nominal Capital: £2,000. Directors: George N. Evans, 3, Park Road, Urmston, Lancs (gov. dir.); Arthur M. Parry, 60, Alexandra Road, South, Manchester. Solicitors: Grover, Smith and Moss, Manchester. Registered by Solicitors' Law Stationery Society Ltd.

Markfield Air-Conditioning Installations Ltd., 36, Southampton Street, W.C.2. Nominal Capital: £100. Directors: Ronald E. Hutton, 13, Bruce Castle Court, Lordship Lane, N.17. David Shepherd, 211 South Norwood Hill, S.E.25. Registered by Solicitors: Lawson (London) Ltd.

Denvic Refrigeration Ltd., 25, Devenish Road, Weeke, Winchester, Hants. Secretary: V. G. Appleby. Nominal Capital: £100. Directors: Victor G. Appleby and Dennis G. Stickland, 25, Devenish Road, Weeke, Winchester, Hants; and Geo. Robson. Registered by Lewis Coates & Lucas Ltd.

K. F. Bartlett Ltd., Mareth, Deepway Gardens, Exminster. Secretary: Kenneth F. Bartlett. To carry on business of refrigeration, mechanical, electrical and radio engineers, etc. Nominal Capital: £500. Directors: Kenneth F. Bartlett, Mareth, Deepway Gardens, Exminster; John I. Lawrence, Olpen, Pines Road, Paignton, Devon. Solicitors: Cocks & Co., Exeter. Registered by Shaw & Sons Ltd.

R. V. Heming (Domestic) Ltd., Cliff Road, Newquay. Secretary: Dorothy Heming. To carry on business of manufacturers of and dealers in refrigeration and catering equipment, domestic appliances and fittings, etc. Nominal Capital: £600. Directors: Roger V. Heming, "Reverie," Chester Road, Newquay, Cornwall; Peter R. Heming, "Sorrento," Trenance, Mawgan Porth, Newquay. Solicitors: R. L. Frank and Caffin, Truro. Registered by Shaw & Sons Ltd.

Freez King International Ltd. To carry on business of manufacturers of and dealers in ice cream freezers and refrigerating equipment and food storage or dispensing cabinets, etc. Nominal Capital: £100. Director: to be appointed by subscribers. Subscribers: Steven E. Q. Henriques (Solicitor) and Alan T. Bruce (clerk), 199 Piccadilly, W.1. Registered by Solicitors: Bartlett & Gluckstein, W.1.

Harrisons (Electrical & Refrigeration) Ltd., 142, High Street, Ryde, I.W. Nominal Capital £2,500. To take over the business of electrical, refrigeration, radio and television engineers carried on at Ryde by F. Harrison. Directors: Fredk. Harrison & Mrs. Barbara E. Harrison, 3-4 West Street, Seaview, I.W. Solicitors: John Robinson & Jarvis, Ryde. Registered by Shaw & Sons Ltd.

Mac's (Cold Store) Ltd., 2, Barley Hall Works, Barley Lane, Goodmayes, Essex. Secretary: Jean Watt. Nominal Capital: £1,000 in £1 shares. Directors: Steve R. Watt and Mrs. Jean Watt, 2, Dunkeld Road, Dagenham, Essex; Edward Crotty, 151, Argyle Road, E.16. Registered by Shaw & Blake Ltd.

Rayleigh Refrigeration Sales & Service Ltd., 9, Weston Road, Southend-on-Sea. Secretary: J. W. Mallinson. Nominal Capital: £100 in £1 shares. Directors: Geoffrey Mallinson, 15, Ravenscourt, Alexandra Road, Southend-on-Sea; Raymond W. Newman, 29 Woodlands Avenue, Rayleigh, Essex. Solicitors: J. P. Nolan and James, Southend-on-Sea. Registered by Shaw & Blake Ltd.

(Continued on page 902)

PATENTS

APPLICATIONS RECEIVED

July 7—York Shipley Ltd. (York Division, Borg-Warner Warner Corporation), C23326 Air-conditioning systems. 10—Cleveland Pneumatic Industries Inc., C23840, Refrigeration apparatus etc. 14—Fearnley, J. H., P24079, Foodstuffs etc. conditioning cabinet. 16—Wilcolator Co., C24472, Air-conditioners etc. temperature control. 17—Wilcolator Co., C24619, Air-conditioners, etc. 18—Pormor Ltd., Nicolson, F., C24761, Refrigerators etc. 31—Minikay Ltd., Jennings, G. E., P26341, Refrigerated spaces, doorways; Hayward, L. G. J., P26261, Refrigerated cabinets. August 5—Smithfield Refrigerator Co. Ltd., Partridge, W. H., P26827, Refrigerators. 18—American Radiator & Standard Sanitary Corporation, C28214 and C28215, Refrigerating systems. 31—Constock International Methane Ltd., Bocquet, P. E. and Tung, S.E., C29696, Temperature refrigeration. September 2—Sanzenbacher, W. A., C30003, Air-conditioning apparatus. 8—Kelvinator Ltd., Saunders, N. F. T., P30632, Refrigerators.

COMPLETE SPECIFICATIONS ACCEPTED

July 29—Carrier Engineering Co. Ltd., 820,683, Air-conditioning; 820,696, Air-conditioning. August 6—Heat Pump & Refrigeration Ltd., 821,079, Heat pump systems; Heron A. G., 820,908, Refrigerating apparatus; Carrier Engineering Co. Ltd., 821,123, Air-conditioning; McFarlan, A. I., 820,912, Air-conditioning system. 12—Armstrong Cork Co. Ltd., 821,372, Method of protecting thermal insulation; Tack Air-Conditioning Ltd., 821,387, Vaporizing devices; Pressed Steel Co. Ltd., 821,410, Refrigerated storage cabinets. 19—Carrier Engineering Co. Ltd. 821,785, Air-conditioning, 821,805, Air-conditioning units and methods of air-conditioning. 26—Electrolux Ltd., 822,053, Absorption refrigerating apparatus. September 2—Heat Pump & Refrigeration Ltd., 822,519, Heat pump systems. 16—Texaco Development Corporation, 823,284, Process and apparatus for effluent refrigeration of an alkylation operation; Garrett Corporation, 823,502, Air-conditioning apparatus.

BUYERS' GUIDE

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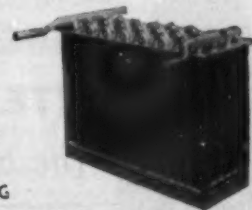
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COMPACT NEW CONTROL FOR "DOMESTICS"



NOW in full production at Teddington Refrigeration Controls, Sunbury Works, is a compact new control unit specially designed to fit into the modern thin wall type domestic refrigerator.

Announcing the Teddington "Thinline" type KCA thermostat, a company spokesman said: "We believe this component meets the requirements of manufacturers who are themselves faced with the demand by housewives for less bulky appliances and more cubic capacity within the refrigerator."

The KCA is only $\frac{1}{4}$ of an inch thick and is claimed to take less insulation space than any other model available on the world market at the present time. Its total weight, complete with feeler and 18 in. capillary tubing, is only 2½ oz.

Teddington Refrigeration Controls emphasize that they have achieved economy of space and weight in the KCA without incurring any penalties in performance.

"In fact," they say, "this little instrument is exceptionally accurate reliable and adaptable."

Teddington Refrigeration Controls have developed an entirely new principle for range setting and the instrument embodies the well-tried capillary and bellows system with a sealed snap switch capable of directly switching up to $\frac{1}{4}$ -h.p. a.c. motors or, when used with an absorption type refrigerator, 500 watts at 220 volts a.c.

Particular attention has been paid to the choice of materials used in construction and, as a result, the Teddington "Thinline" KCA thermostat is completely unaffected by moisture or food acids.

Heat & Air Systems Ltd., 172 Buckingham Palace Road, S.W.1.,

announce that Mr. E. A. Barker, manager of their Stockport branch, has been appointed to the board.

During the recent Royal visit to Stevenage New Town, Her Majesty the Queen showed a great interest in the people and their way of life in this remarkable new background. In a three-hour tour, Her Majesty spoke to builders, workmen and shop assistants, as well as to prominent officials, and visited many of the buildings which play an important part in the lives of the ordinary people of the town. In the new town centre Her Majesty unveiled a commemorative plaque, set in the clock tower, and named the main pedestrian avenue "Queensway." Broad shopping avenues such as "Queensway" are a feature of this new town centre which impressed, not only Her Majesty, but everyone who has seen them. Limited to pedestrians only, they are spacious, airy and attractive, flanked on both sides by bright and interesting shop windows. Here the housewife can wander at leisure and stop to look in or talk to friends with no inconvenience to passers-by. Never is a shopper—perhaps with a pram—obliged to step off a pavement on to a possibly dangerous road, to go around a chatting group. Supplies for the shops facing onto these avenues are delivered by service roads at the rear, where vehicles can be parked and unloaded with complete freedom from congestion and inconvenience. After the unveiling ceremony Her Majesty met representatives of the town's inhabitants and visited many of its buildings.

One of these buildings selected for a visit by the Queen was the butcher's shop, in Market Place (one of the main shopping avenues) owned by

Mr. Geoffrey Shepherd, secretary of the local Master Butchers' Association. Inside the shop the Queen saw a baron of beef which, she learned, came from an animal from her uncle's estate at St. Paul's Waldenbury. Prestcold equipped, by The Bedford Refrigeration Co., Ltd., Mr. Shepherd's butcher's shop is very modern and attractive in its appearance. The window is dominated by a special 8-ft. marble-decked, refrigerated window display unit with automatic defrosting equipment. Mounted on castors for easy mobility, it is completely self-contained and the design incorporates a $\frac{1}{4}$ -h.p. Prestcold condensing unit. Other refrigeration equipment comprises a 6-ft. open-topped, cooked-meat cabinet with refrigerated storage space in its lower part, and a 550-c.ft. cold room with a forced-air unit cooler operated by a $\frac{1}{4}$ -h.p. condensing unit. The cold room has an automatic, hot-gas defrosting system.

Mr. Norman Staff, J.P., A.C.A., has been appointed managing director of Winget Limited. Mr. Staff first became associated with Winget Limited in 1929 when he was a junior auditor at Warwick. Mr. Staff is also a member of the boards of directors of Winget-Syncro Limited, Winget Refrigeration Limited, Winget Services Limited and Moore's Plant Limited.

We learn that Mr. A. Wilkinson retired from the position of managing director of The Spiral Tube & Components Co. Ltd. during the summer to become deputy chairman of the company. He has been succeeded by Mr. K. J. Wilkinson, formerly deputy managing director. Mr. A. Wilkinson joined the company in 1915 and has been managing director for 25 years. Mr. K. J. Wilkinson was originally employed in the drawing office in 1931 and after taking charge of the factory he became a director of the company 10 years ago and deputy managing director in 1953. He is a past chairman of the Derby branch of the British Institute of Management and of the Notts & Derby branch of the Institution of Works Managers.

Electrolux and Frigidaire refrigerators were displayed by United Africa Co. on one of their many stands in the trade and industry exhibition at the Festival of Kano in Northern Nigeria. A working unit of the former was shown.

Ada use Zintec for Cabinets

ZINTEC, the steel sheet with a thin coating of pure zinc, electrolytically deposited, produced by John Summers & Sons Ltd., Shotton, Chester, is being used in the manufacture of refrigerators by Ada (Halifax) Ltd., Halifax, Yorks, the well-known appliance makers.

Production of the refrigerators started recently at one of the company's three factories in Halifax. This is the first time the company has entered the refrigerator field. An output of 500 a week, rising to 2,000 a week, is planned, produced by the most modern methods.

The special plant includes a £45,000 American Ransberg electrostatic painting and finishing machine, believed to be the first in this country.

Production at first will be concentrated on models with a capacity of 4.6 cu. ft. with a total shelf area of 8 sq. ft. Height is 35½ in. width 24 in. and depth including handle, 25 in. Later, refrigerators of 8 cu. ft. capacity are planned.

Zintec will be used for the cabinet of the refrigerators. Because of its special coating, Zintec gives added protection against corrosion; it also has manufacturing advantages—sheets or pressings can be stored without danger of corrosion and the consequent necessity of recleaning before finishing. Manufacturers state that the coating is also kind to tools.

The use of Zintec is not new to Ada. They have been using it six years for the cabinets of their washing machines.

Another Summers' product, Galvatite, a continuously galvanised sheet, has been used for nearly as many years, for the chassis of the washing machines.

It is planned to extend the production of Ada washing machines and the Adamatic washer-spin drier—now totalling 1,300 a week—when an extension to the Johnson Street factory is completed next year.

New Cold Store Extensions for Lightfoot Cold Stores Ltd

THE continued expansion of the frozen food industry promotes the construction of new extensions for existing cold store facilities. Keeping pace with this expansion Lightfoot Cold Stores Ltd. have had four new extensions built by Smiths Insulations Limited of Burton-on-Trent at Southampton, Bedford, Hove and Aldershot.

The Southampton store is built in a basement under two stores built about 18 months ago by Smiths, and it is 118 ft. long by 29 ft. 6 in. wide by 9 ft. 6 in. high. There is 8 in. cork to walls and floor and a 6 in. cork ribbon to the ceiling adjacent to the walls. A superfreeze type insulation door is included and a hatch for a conveyer.

At Bedford the new store is 58 ft. by 26 ft. by 10 ft. 6 in. high inside and has 8 in. cork to walls, floor and ceiling.

The store at Hove adjoins an existing store and measures 92 ft. by 20 ft. by 9 ft. 6 in. high, inside. There is 8 in. cork insulation to the walls and ceiling and 6 in. cork to the floor. A dry air lock is incorporated at one end.

A more complicated construction was required at Aldershot where a roof was built over existing brickwork with a suspended ceiling. Insulation is achieved with 6 in. cork throughout. Two more stores are to be built here as part of an extension programme, one of which is already under construction by Smiths.

Common to all of these new stores is air cooling by ducting, dunnage wall battens, and polar white walls and ceiling and granolithic floors.

New Companies

The accompanying particulars of New Companies recently registered are taken from the Daily Register compiled by Messrs. Jordan and Sons Ltd.

Axim Cara-Frig Ltd., 167, High Street, Guildford, Surrey. Secretary: Kathleen F. Simmons. To carry on business of manufacturers of and dealers in refrigerators and other cold storage apparatus, plant and equipment, etc. Nominal Capital: £1,000. Permanent Directors: Alfred S. F. Simmons and Mrs. Kathleen F. Simmons, Longmead, Winchester Road, Four Marks, Alton, Hants. Registered by Chas. Davy and Co., Ltd.

Zero Engineering Co. Ltd. To carry on business of refrigeration mechanical, electrical and radio engineers, etc. Nominal Capital: £2,000. Director: not named. Subscribers: Wm. N. Yates, East Street, Tonbridge (Solicitor). Jasmin A. Wilson, 8, Commercial Road, Tonbridge (Secretary). Solicitors: Walker, Templer and Thomson, Tonbridge. Registered by Shaw & Sons, Ltd.

Douglas A. K. Clarke Ltd., Warrington House, 224, Crookesmoor Road, Sheffield, 10. Secretary: Ivy J. Clarke. To take over business of a refrigeration and electrical engineer carried on at Crookesmoor Road, Sheffield, by Douglas A. K. Clarke, etc. Nominal Capital: £1,000. Directors: Douglas A. K. Clarke and Mrs. Ivy J. Clarke, 54 Ringstead Crescent, Sheffield, 10. Solicitors: Davidson and Co., Sheffield. Registered by Shaw and Sons, Ltd.

Deep-Freeze Promotions Ltd. Secretary: Stella P. J. Facchino. To carry on business of dealers in ice-cream cabinets, ice and ice cream making machines, etc. Nominal Capital: £100. Directors: Joseph J. Facchino, 169, Station Road, Knowle, Warwicks; Stella P. J. Facchino, Alton Lodge, Gravelly Hill North, Erdington, Birmingham. Solicitors: M. L. Prior, Birmingham. Registered by Shaw and Sons Ltd.

Refrigeration Installation Engineers Ltd. Nominal Capital: £5,000. Directors: Ruben Warren, 220 Bellingham Road, Catford, S.E.6; Arthur W. Warren, 4, Celtic House, Shortlands, Kent, Geo. Warren and Wm. C. Harris. Registered by Stanley, Dean and Co. Ltd.

Electricold Refrigeration Manufacturing Co. Ltd., 13, Hillbury Road, Whyteleafe, Surrey. Secretary: D. T. A. Poulter. Nominal Capital: £1,000. Directors: Fredk. H. Spargo and Doris I. Spargo, 37, Tithepitshaw Lane, Warringham. Registered by Denis Poulter & Co., W. L.

Spanish Experimental Centre for Refrigeration

THIRD GENERAL ASSEMBLY

The 3rd general assembly of the Centro Experimental Del Frio was held recently in Madrid.

The inaugural session, which took place in the auditorium of the Consejo Superior de Investigaciones Científicas (High Council for Scientific Research), was opened by Mr. Rufino Beltrán Vivar, chairman of the C.E.F. board of managers, who addressed a few words of welcome to the participants. The assembly was attended by 391 participants, including 259 members and 132 associates.

On the first day was held a meeting on the theme: "Cold production and distribution." In connection with this theme the following papers were submitted:—

"Applications of modern high-speed multicylinder compressors," by Juan Pedro Sesé Arusaga.

"Centrifugal compressors," by Juan Pedro Sesé Arusaga.

"A study of the progress in refrigerating machines design and construction," by Luis Díaz de Tudanca Bacaicoa.

"Some remarks about the performance and design of evaporators," by José Martín López.

"The combination of absorption or resorption machines with refrigerating compressors," by Ferdinand Creuzot.

"The cascade refrigerating plant designed for vinyl chloride recovery," by Eugenio Guruceta Galdós.

"Automatic 'Freon-12' systems aboard refrigerator ships," by José Rodríguez Pino.

"About the use of some hydrogenated refrigerants," by Manuel Arana Romero.

"The lubricating oils in refrigerating plants," by Fernando Beltrán Cortés, Collaborator to the C.E.F.

"Determination of impurities in refrigerating machine lubricants," by José Moreno Calvo, at the C.E.F. Researcher.

"Interactions between fluorochloro-derivatives from hydrocarbon and lubricating oils," by José Moreno Calvo, C.E.F. Researcher.

"Lubrication of refrigerating machines," by Luis Abenza Fernández.

All the above papers were certainly noteworthy. The result was to recommend the C.E.F. to undertake a study of Spanish lubricating oils in order to determine rules concerning their use in refrigerating plants.

The next day the working sessions continued with a meeting on the 2nd theme: "Applications of refrigeration to perishable foodstuffs as oriented towards the home and foreign trades in accordance with the new plans of the Spanish Government."

The papers submitted for this meeting were:—

"Changes in the activity of acid phosphomonoesterase during the germination of refrigerated seeds," by Enrique Castellá Bertrán.

"Plant product changes connected with refrigeration: transformation of chlorophyll," by José Moreno Calvo, researcher of the C.E.F.

"Plant product changes connected with refrigeration: (a) Mouldiness; (b) Fruit browning," by José Moreno Calvo, research worker in C.E.F.

"Some economic aspects of cold treatment and storage of 'Trocadero' lettuces," by José Antonio Muñoz-Delgado Ortiz, Antonio Valdecantos Jiménez, Luis Muñoz-Delgado Ortiz and Rafael Pozo Fernández, secretary and collaborators of the C.E.F., and Manuel Estada Girauta, director of the C.E.F.

"Economic repercussions of ethylene appearance during cold storage of plant products," by José Moreno Calvo, research worker, C.E.F.

"Freezing of fruits and vegetables. I. General methods," by José Antonio Muñoz-Delgado Ortiz, secretary of the C.E.F., and Manuel Estada Girauta, director of the C.E.F.

"Freezing of fruits and vegetables. II. Special techniques," by José Antonio Muñoz-Delgado Ortiz, secretary of the C.E.F., and Manuel Estada Girauta, director of the C.E.F.

"The properties and the function of protective wraps for frozen plant products: the use of silicones and other means," by José Moreno Calvo, research worker of the C.E.F.

"Culinary quality of some Spanish quick-frozen fruits and vegetables," by José María Busca Isusi.

"A research pilot-plant for experimental work on cold treatment and storage of products from vegetable origin," by Eugenio Guruceta Galdós.

"Experimental data about the necessity for a full cold chain in butchers' shops," by Enrique Castellá Bertrán.

"Cold treatment of animal products, combined with the use of adjuvants: (a) antibiotics; (b) antioxidants; (c) other agents," by José Moreno Calvo.

"Cold treatment and long-term cold storage of pork," by Antonio Valdecantos Jiménez, C.E.F. collaborator, and Félix Sanz Sánchez, member of the C.E.F. board of managers.

"Problems arising in meat freezing: (a) study of the temperature fluctuations during the freezing process; (b) methods of preventing weight losses," by José Moreno Calvo, C.E.F. Researcher.

"The effects of refrigeration and of the ionizing radiations on the preservation of animal products," by Antonio Valdecantos Jiménez, C.E.F. collaborator, and José Antonio Muñoz-Delgado Ortiz, secretary of the C.E.F.

"The use of aureomycin in cold storage of chickens," by Antonio Valdecantos Jiménez, Rafael Pozo Fernández and Luis Muñoz-Delgado Ortiz, collaborators of the C.E.F.

"Experimental data concerning the Madrid milk quality. The results of non-pasteurization and of the lack of a cold chain," by Enrique Castellá Bertrán and Gabriel Colomo de la Villa.

"Undesirable changes in eggs as a result of refrigeration: (a) browning; (b) rot; (c) mould," by José Moreno Calvo, C.E.F. research worker.

"Industrial refrigeration, a necessary factor to improve the current low-grade quality of eggs in Spain," by Enrique Castellá Bertrán.

"Cold treatment of wines intended for export," by Miguel Blanco Casal.

"Some comments on the use of wraps for the protection of foodstuffs," by Cristóbal de la Puerta Castelló, Luis Muñoz-Delgado Ortiz and Rafael Pozo Fernández, collaborators of the C.E.F.

The 3rd theme: "Stationary refrigerating plants," brought together the following papers:—

"Gas chromatography as a method of assaying the substances produced in cold stores," by José Moreno Calvo, C.E.F. research worker, and Angel Santos Ruiz, member of the C.E.F. board of managers.

"Some remarks about handling of frozen foods in cold stores and supermarkets," by José Moreno Calvo, C.E.F. research worker.

"The goods traffic in refrigeration industry," by Juan Hens Tienda, collaborator of the C.E.F.

"The development of frozen-fish economics in Spain," by Magin Vinielles Trepas and Juan Morales Sánchez.

"Applications of refrigeration in food preservation and marketing," by Pascual Cervera Abreu.

"Remarks regarding some commercial difficulties arising in the operation of cold stores," by Francisco Landaluze Asensio.

"Problems encountered by the Spanish fish-canning factories," by Gaspar Massó García.

"The use of refrigeration in connection with supermarkets," by José D. Esteban y Fernández.

"Refrigerating equipment needed in a self-service business dealing with food products," by Luis Díaz de Tudanca y Bacaicoa.

"The importance and present situation of domestic refrigerators," by Fernando Beltrán Cortés, collaborator of the C.E.F.

"Progress made in the refrigerating equipment of Portuguese high-sea trawler fleet," by Adriano Duque Monteiro Leite.

The 4th theme was "Mobile refrigerating plants." In connection with this theme the following papers were presented:—

"Railway refrigerated transport," by Angel Mendoza Lozano.

"Notes on refrigerated transport by rail in the Soviet Union," Antonio Moreno de Guerra y Pérez, member of the board of managers of the C.E.F.

"A new cellular insulant based on polyvinyl for use in mobile refrigerating plants," by Luis Pla Parcet.

In the afternoon of the same day, a discussion was held on the topic: "Disinfection and deodorization of cold rooms." As a result of the discussions, the following conclusions were reached: (1) to investigate new physical agents for disinfection and deodorization of cold chambers, as the existing ones have failed to bring an effective and final solution (2) in compliance with suggestions made by the participants, to entrust the C.E.F. with the task to investigate the main physical and chemical agents for disinfection and deodorization of cold rooms. This interest clearly shows the importance that Spanish refrigeration industry is attaining to such problems and encourages the C.E.F., which has included the 4th theme in its working programme, to devote itself to the study of these questions.

Meeting on the 5th theme: "Industrial and other applications of refrigeration."

In the 5th theme, the following papers were presented:—

"Water-accumulator central refrigerating plants and full-load central refrigerating plants for air-conditioning plants," by José Laorden Jiménez.

"Air-conditioning of large buildings," by Luis Rotache Chilbaud.

"Physiological comfort zone limits in air-conditioning," by José Moreno Calvo, C.E.F. Researcher.

Of those papers, the first two—presented by Mr. José Laorden Jiménez and by Mr. Luis Rotache Chilbaud, who discussed the advantages and disadvantages of the system—are worthy of special mentions.

In the afternoon of the same day was held the meeting on the 6th theme: "Education in Refrigeration." At this session the following papers were presented:—

"A standard programme for a course in bio-chemical fundamentals of refrigeration," by José Moreno Calvo, C.E.F. researcher and Angel Santos Ruiz, member of the C.E.F. board of managers.

"Commentaries on a training course programme for refrigeration fitters and machinists," by Fernando Beltrán Cortés, C.E.F. collaborator, and Manuel Estada Girauta, director of the C.E.F.

"Circulation of instructions on the treatment of frozen foods: disinfection of cold chambers," by José Moreno Calvo, C.E.F. researcher and Fernando de la Cámara Cumella, member of the C.E.F. board of managers.

"The spreading of culinary techniques adapted for frozen foods, the final link of the cold chain," by Enrique Castellá Beltrán.

"The training of refrigeration-canners in the Spanish Bachillerato Laboral Superior" (Higher Industrial Baccalaureate), by José Pontón Fernández.

Here the following papers deserve to be specially underlined on account of their importance and of the number of discussions they aroused after being read: "Commentaries on a training course programme for refrigeration fitters and machinists" presented by the C.E.F.; "The spreading of culinary techniques adapted for frozen foods, the final link of a cold chain," by Enrique Castellá Beltrán, and "The training of refrigeration-canners in the Spanish "Bachillerato Laboral Superior."

As a result of these discussions, a fundamental task will fall on the C.E.F., as it was recommended that it should act as a centralizing body dealing with all inquiries which may arise in the field of education in refrigeration.

Finally, one can mention the lectures that were delivered under the Assembly Programme:—

Plenary. "Co-operative research," by Professor Dr.

Manuel Lora Tamayo, president of the consulting board for Scientific and Technical Research and general secretary of the "Juan de la Cierva" Board of Governors for Technical Research.

Commission meeting, "Refrigeration applications to the dressing, treatment, transportation and storage of perishable products intended for the supply of a supermarket chain," by M. Jean Bernard Verlot, President of the V Commission (Cold Stores and Ice-Making Plants) of the International Institute of Refrigeration, and Chief Engineer at the Direction Commerciale de la S.N.C.F. (Société Nationale des Chemins de Fer Français).

"Recent Danish Observations on the chilling of pork carcasses," by M. Mogens Jul, director of the Danish Meat Research Institute (Slakteriernes Forkningsinstitut) at Roskilde.

"About the use of refrigeration in the preservation of perishable food products, and comparison of this method with other methods of preservation" by Mr. Manuel Estada Girauta, director of the Centro Experimental Del Frio.

"Effects of cold treatment and cold storage on the nutritive value of food products" by Dr. Francisco Vivanco Bergamín, Member of the "Patronato Nacional de Higiene de la Alimentación y de la Nutrición."

All these lectures were followed with interest by the participants, who greeted the speakers with enthusiastic applause.

On the afternoon of February 26, the C.E.F. Members met in exclusive session, where they were informed in detail on the work accomplished by C.E.F. since the last meeting, and the new representatives of the C.E.F. Members at the board of managers were elected.

The closing session was held before a full assembly in the auditorium of the Consejo Superior de Investigaciones Científicas. The session began with the lecture delivered by Dr. Vivanco Bergamín, which was followed by a report on the proceedings of the Assembly by Manuel Estada Girauta, Director of the C.E.F. After this, M. Mogens Jul, speaking for himself and in the name of the International Institute of Refrigeration, which he himself was representing, thanked the organizers for the attentions paid to him and congratulated them on the success of the III General Assembly. Then, Mr. Jerónimo Ossorio de Castro, on behalf of the Portuguese delegation and himself, also acknowledged the kindly attentions received and complimented the organizers with the expression of all good wishes for the success of the C.E.F. work.

Finally, in brief closing speech, Mr. Rufino Beltrán Viver, president of the C.E.F. board of managers, after thanking all the participants for their co-operation, emphasized the importance of the General Assemblies of the C.E.F., which have, above all, the effect of further tightening the bonds between the refrigeration industry and the researchers.

OPENING IN WESTERN GERMANY

"Carmen" Jakob Reith Hohenschaeftlarn bei Muenchen, Zechstr. 10, have told the British Consulate-General at Munich that they would like to get in touch with United Kingdom manufacturers of small refrigerators. The German firm are particularly interested in refrigerators with a capacity of between 40 and 60 litres. They estimate that they can sell approximately 3,000 per year. It is understood that they are primarily interested in purchasing on their own account but that should business develop favourably they would be prepared to consider an agency arrangement. The firm of "Carmen" was founded in 1928 and Herr Jakob Reith is the sole proprietor. They are engaged with the distribution of refrigerators, central heating units and oil burners, and employ several persons. The "Carmen" concern are considered to be a suitable connection for United Kingdom firms. Manufacturers interested in this enquiry should write direct to the German concern. It would be appreciated if, at the same time, they would notify the British Consulate General, Akademiestrasse 7-9, Munich 13, that they have done so.

Food Research in Great Britain *

THE Agricultural Research Council has continued its efforts to achieve the best possible co-ordination between the work carried on under its guidance and the needs of the industry. The joint committee of the council together with the improvements councils for England and Wales and for Scotland, whose work was described in the first annual report, has made surveys of the needs of further commodities and allotted priorities to the individual problems, after extensive consultation with the appropriate bodies representing the industry. These assessments of priorities have been examined by the council in relation to the work in progress.

Future of Food Research

Meat production presents another series of problems urgently in need of more work. These fall into two parts: one the breeding, rearing and feeding of cattle, sheep and pigs and the other the slaughter, handling and processing of the carcasses. These two groups of problems are obviously closely interrelated; the producer of the live animal can only measure the results of his work in terms of the final carcass; equally the scientist investigating the meat aspects of the work must know the history of the animal, the carcass of which he is studying. Under the existing arrangements the first group of problems is the responsibility of the council, whilst the second is that of the Department of Scientific and Industrial Research. Whilst there has been useful co-operation between the scientists working for the two councils, it is clearly an unsatisfactory arrangement that the two parts of what is in effect one research problem should be administered by different organizations, states the A.R.C. report.

The same division of effort is to be found in other branches of food production, e.g. fruit growing and storage, vegetable growing and the methods of handling, packing and distribution.

These difficulties were recognized by the Department of Scientific and Industrial Research in 1956 and the department proposed to the council that it should take over certain of the laboratories dealing with food research. Whilst welcoming the proposal that research on the production of food should be integrated with that on its processing and storage, the council considered that before any step was taken a careful examination of the present, and future, needs of the food side of the industry should be made. The Ministry of Agriculture, Fisheries and Food was asked to prepare an estimate of these needs and this was examined by a sub-committee of council members in relation to the facilities already available to the council for the study of dairy products, fruit juice and cider, and to a lesser extent for the storage and handling of fruit and vegetables, in order to estimate what further facilities would be needed and how far these would be met by the proposed transfer

of laboratories from the D.S.I.R. After careful consideration, the council concluded that to fulfill the obligations it would be undertaking to the Ministry of Agriculture, Fisheries and Food it would be essential to provide for the transfer of another laboratory, in addition to those originally proposed by the D.S.I.R.

Negotiations with the D.S.I.R. have been going on throughout the year under review and agreement has now been reached for the transfer to the council of the Low Temperature Research Station, the Ditton Laboratory and the Pest Infestation Laboratory.

While the council was examining the question of the transfer of these laboratories, the meat research committee of the M.A.F.F. was considering how far the demand for a meat research institute was justified. They were helped in this examination by the loan of the services of Dr. Vickery, the leading authority on meat research in Australia, and on the basis of his report the committee recommend the establishment of a meat research centre. It will be one of the council's first tasks, when the responsibility for food research is transferred, to study how best this recommendation can be implemented.

New Method of Determining the Moisture Content of a Circulating Refrigerant

A. W. Diniak, E. E. Hughes and M. Fujii, staff scientists of the U.S. National Bureau of Standards have recently developed a new, simple and rapid method for determining the water content of a circulating refrigerant of the fluorocarbon group.

Based on the change in electrical resistance of an electrolytic film as it absorbs water vapour, the method is an application of the electrical conductivity method for determining water vapour in gases, developed and used for many years by E. R. Weaver of the bureau's staff. The method is highly sensitive, gives accurate results, and does not require the removal of a sample from the circulation cycle. Determinations can be made repeatedly without difficulty, making it possible not only to determine the water content of the refrigerant but also to follow and determine continuously its instantaneous water content before and after passage through a drier.

In commercial refrigeration systems the presence of water in the refrigerant constitutes a serious problem because freezing of the expansion valve and corrosion are always possibilities. Until now there has been no completely satisfactory procedure for determining the moisture content of a circulating refrigerant. Although several good methods for determining the moisture content of refrigerants in static containers are available, none of these is readily adaptable to a circulating refrigerant, chiefly because they require the removal of large samples, which would upset the

* Extracts from: The Annual Report of the Agricultural Research Council.

steady state of the cycle. Such methods are also time-consuming and require much experience with the method involved.

In contrast, the new method is very quick, simple, and convenient. Once a sampling and a return point have been placed in the system, the measuring apparatus can be quickly connected and a determination made in 15 or 20 minutes.

The principle of the method has been used at the bureau for some time, chiefly to measure small amounts of water vapour in gases. A thin film of hygroscopic material—usually a mixture of sulphuric and phosphoric acids—is spread over the surface of a solid insulator between metallic electrodes in a pressure-tight enclosure. The electrolyte tends to reach equilibrium with the water vapour in the surrounding gas and to form a solution whose electrical conductance is a measure of the concentration of water vapour in the gas. This conductance is indicated by a simple electronic circuit and a microammeter.

A gas of known moisture content is used to calibrate the film after each reading. By adjusting the pressure of the comparison gas until the same conductivity reading is obtained for both the known and unknown gas, the two gases can be made to have the same water concentration. The unknown water content can then be calculated from the two pressures and the known water content of the comparison gas at atmospheric pressure.

Usually the comparison gas has been saturated at a high pressure (about 1000 psi) and room temperature in a specially designed saturator and then permitted to expand for use. For very dry systems a secondary comparison gas is employed. This is simply a quantity of fairly dry air whose moisture content has been previously determined by comparison with the saturated air.

Because of the pressure relationships involved and because a liquid would wash away part of the hygroscopic film, the electrical conductivity method can only be used to make moisture determinations of samples in the gaseous state. Thus, in the equipment constructed at the bureau, a very small amount of the

circulating refrigerant is "detoured" from the system, vaporized by heating, passed through the pressure chamber containing the hygroscopic film, and returned to the suction line for recirculation.

To prevent fractionation which would take place if only part of the liquid sample were vaporized, it is necessary to withdraw the sample through a capillary tube so that the entire sample may be continuously vaporized. The capillary tube, dipping into the main stream of liquid refrigerant, carries a portion of the liquid to an electrical resistance heater which vaporizes the refrigerant.

To ensure complete vaporization, the tubing containing the liquid refrigerant is wound loosely around the heater in the form of a helix and is thermally insulated from the ambient air. The vaporized refrigerant is then led to the detector block—a specially built, pressure-tight enclosure containing the moisture-detecting element. By manipulating three control valves in the detector block, either refrigerant vapour or the comparison gas can be caused to flow past the hygroscopic film. However, the detector block is so constructed that the flow of refrigerant vapour through it is never interrupted; it is merely cut off from the detecting film. Condensation of the refrigerant in the detector block is prevented by placing the heater near enough to keep the refrigerant heated to just above its saturation temperature at the pressure of the liquid line.

After leaving the detector block, the refrigerant vapour passes through a regulating valve which controls and limits flow through the sampling circuit; it then returns to the main line of the refrigerating system for recirculation.

To establish the validity of the electrical method for moisture determinations in a refrigerant, the bureau compared results obtained by this method with the results of gravimetric determinations by the phosphorus pentoxide absorption method. Both types of determinations were made on the same or similar samples of refrigerant at the same, or very nearly the same, time. No important discrepancy was found between the results obtained by the two methods.

Restrictive Trade Practices

By LORD MESTON

THE Restrictive Trade Practices Act, 1956, has been in operation for a little more than two years, and it may be useful to see how that statute has been working.

It will be remembered that, subject to certain exceptions, the Act has to be registered with the registrar of restrictive trading agreements:—

"Any agreement between two or more persons carrying on business within the United Kingdom in

the production or supply of goods, or in the application to goods of any process of manufacture, whether with or without other parties, being an agreement under which restrictions are accepted by two or more parties in respect of the following matters, that is to say:—

(a) The prices to be charged, quoted or paid for goods supplied, offered or acquired, or for the application of any process of manufacture to goods;

(b) The terms or conditions on or subject to which goods are to be supplied or acquired or any such process is to be applied to goods ;

(c) The quantities or descriptions of goods to be produced, supplied or acquired ;

(d) The process of manufacture to be applied to any goods, or the quantities or descriptions of goods to which any such process is to be applied ; or

(e) The persons or classes of persons to, for or from whom, or the areas or places in or from which, goods are to be supplied or acquired, or any such process applied."

Restrictive trading agreements having been registered, it is then necessary to examine them and determine whether they should be allowed to go on or be stopped. This matter is determined by the restrictive practices court of which the president is Mr. Justice Devlin. It is the registrar of restrictive trading agreements who makes the application to the restrictive practices court to have this matter determined, and this court may make such order as appears to it to be proper for restraining persons from enforcing the particular agreement.

It is interesting to note that by the end of 1958, 2,100 agreements had been registered. During 1957 and 1958, the parties to over 140 of those agreements were advised that it was intended to refer their agreements to the restrictive practices court which has to decide whether they are contrary to the public interest. In 55 of these cases, the registrar has been informed that the agreements have either been abandoned altogether or so altered as to remove all registrable restrictions from them ; and similar steps have been taken in respect of some 40 further agreements. Proceedings have been formally instituted in over 50 cases, of which two were heard by the restrictive practices court in 1958, and dates have been fixed for the hearing of seven more during 1959.

It may therefore be interesting to review those cases which have been actually decided up to date.

One of the cases in which registration is *not* required relates to what are popularly known as "sole agency agreements." Such agreements are exempt from registration where (i) there are no more than two parties to the agreement, neither of them being a trade association, and (ii) all the restrictions relate to goods of the same description. A "sole agency agreement" is in effect an arrangement under which a manufacturer appoints one particular trader to handle his goods in a particular area. The ordinary form of sole agency agreement is an agreement between two persons, both of them entering into restrictions with regard to supply.

This very point came before the restrictive practices court in *Re Austin Motor Co. Ltd.'s Agreements* (1957). This well-known company, which carries on the business of manufacturing motor-cars, had a system of annual *multipartite* agreements between itself and its distributors and dealers. Those agreements were undoubtedly registrable under the Restrictive Trade Practices Act, 1956. However, in February, 1957, the company entered into a new type of agreement.

This was *bipartite* that is to say, made as between two parties, and actually concerned only the company and the dealers. Under the new agreement the dealers agreed to purchase the vehicles from the company or from such source as the company should direct. It was held that the court could only take the new agreements as they stood ; since they were clear and unambiguous, the surrounding circumstances—that is to say, the previous methods of doing business by the company—could not be invoked for the purpose of construing the new agreements. Hence, the new agreements were exempted from registration by the 1956 Act.

However, if an agreement is registrable, any restriction accepted in pursuance of the agreement is deemed to be contrary to the public interest unless the court is satisfied of any one or more of seven different circumstances, which are specified in detail in the 1956 Act. For the moment we need discuss only two of those circumstances, namely (a) that the restriction is reasonably necessary, having regard to the character of the goods to which it applies, to protect the public against injury . . . , (b) that the removal of the restriction would deny to the public other and substantial benefits or advantages . . . and is further satisfied (in any such case) that the restriction is not unreasonable having regard to the balance between those circumstances and any detriment to the public or to persons not parties to the agreement resulting or likely to result from the operation of the restrictions.

The question of "protection to the public" came before the restrictive practices court in *Re Chemists' Federation Agreement* (No. 2) (1958). The Chemists' Federation, which consists of manufacturers of proprietary medicines, wholesalers and retail chemists, by its rules imposed on its members a number of restrictions designed to prevent the sale to the public of proprietary medicines manufactured by its members otherwise than by qualified retail chemists. It was contended by the federation that the sale of proprietary medicines should be restricted to a chemist's shop where there was in attendance a qualified chemist who was able to give advice or warning to his customers in relation to the medicine. This restriction, said the federation, afforded a protection to the public against injury and the removal of the restriction would deny to the public other specific and substantial benefits or advantages. After hearing a great deal of evidence in this matter, the restrictive practices court held that the above restriction was *not* reasonably necessary for the protection of the public because the risk of injury was too slight to justify so wide a restriction and because, even if the risk had been greater, the restriction afforded no real protection against it. Furthermore, the court held that the removal of the restriction would not deprive the public of any substantial benefit or advantage.

Two questions arose for consideration in the latest case which came before the restrictive practices court (February, 1959), namely *Re The Yarn Spinners Agreement*. Those questions were (1) whether the

removal of the restriction would deny to the public substantial benefit; (2) whether the removal of the restriction would be likely to have a serious and persistent effect on the general level of employment in the area, this being another of the seven circumstances which the court may be called upon to consider. The facts of that case were that the members of the Yarn Spinners' Association, who formed a section of the Lancashire cotton industry, entered into an agreement to become members of that association. By virtue of the agreement the members were obliged to charge not less than the minimum prices from time to time fixed under the terms of the agreement for yarn, and were obliged not to sell any yarn the minimum price of which was controlled by the agreement on any terms or conditions more favourable to a customer or agent than those fixed from time to time under the agreement. A great deal of evidence was given on these matters, and it was held by the restrictive practices court that (1) the association had *not* satisfied the court that the removal of the restrictions would deny to the public as purchasers benefits that were substantial; (2) though the removal of the restrictions would be likely to have a serious and persistent effect on unemployment in areas where a substantial portion of the industry was situated, yet it would be unreasonable to continue the restrictions for the industry ought to be made smaller and more compact. The net result was that the above-mentioned agreement was deemed to be contrary to the public interest.

The cases we have discussed may not affect the reader's particular trade or industry, but they are very important as indicating the types of question that may arise in any form of commerce. Then there is the

question of resale price maintenance which has come before the High Court (Chancery Division) and not before the restrictive practices court. It is a very important branch of the whole subject of restrictive trade practices and may be usefully discussed on a later occasion.

"Synthetic" Atmosphere

Created in the Laboratory for Air Pollution Research

RESEARCH on the sources and composition of air pollutants requires a means of creating polluted atmospheres under controlled conditions. For this reason, a stainless steel closed chamber and its related "gas handling" system were recently developed at the Stanford Research Institute, California, in connection with studies on methods of producing, sampling and analyzing air pollutants, singly or in varying combination.

Filtered air and known quantities of one or more pollutants—in gaseous or particle form—are piped into the 2,000-litre chamber. After thorough mixing by "fan-stirring," the resulting synthetic atmosphere is withdrawn over a 2-hour period. Samples are analyzed to determine the concentration present of the contaminants introduced into the chamber.

Provision is made for temperature and humidity control of the synthetic atmosphere in the chamber. The chamber ends are hemispherical, facilitating circulation to mix the air and the pollutants.

The system can be easily adapted for use with closed chambers ranging up to 1 million litres in capacity.

NEW MOTOR FOR AIR-CONDITIONERS

A NEW shaded-pole motor which can adjust to replace fan motors in room air-conditioners and furnace blowers has been introduced by the U.S. General Electric.

The new motor, $5\frac{1}{2}$ in. in diameter, is designed to meet the increasing problem of servicing air-conditioners caused by the large variety of motor lengths installed in units in use to-day. These variations result from a trend to thinner units using shorter model fan motors. The new G.E. replacement motor permits substitution, with some minor adaptations, for almost any $5\frac{1}{2}$ -in.-diameter shaded-pole motor.

The new adjustable mounting adapter is supplied with the motor to be installed by the repair or service man. The adapter is mounted on the motor's extended-through-bolts so that it can be adjusted axially along the motor shaft. This allows a variety of mounting-ring locations. For example, by adjusting the position of the mounting adapter on the General Electric four-pole, $\frac{1}{2}$ -h.p. service motor, mounting dimensions ranging from a minimum of $4\frac{1}{2}$ in. to a maximum of $5\frac{1}{2}$ in. can be duplicated.

For applications requiring band mounting of the

motor or for mounting by the motor's through bolts, the adapter can be omitted to provide for minimum motor length.

Included with the new shaded-pole replacement motor are $2\frac{1}{4}$ -in.-diameter mounting rings which are assembled on the motor adapter. For applications requiring $2\frac{1}{4}$ -in.-diameter mounting rings, additional ring adapters are supplied which will increase the cushion-ring diameter to $2\frac{1}{2}$ in.

Accessory mounting rings, not supplied with the motor, are also available to meet other variations in motor mounting on air-conditioners and heaters.

Extra long double shaft extensions with maximum-length flats are standard on the General Electric replacement motor. Where necessary, the shafts can be cut to intermediate lengths or to single-shaft requirements. Gunmetal-like finish on these shafts helps protect against corrosion and provides for easy removal of fans and blowers.

The motor is available in the following shaded-pole ratings: four-pole models from $\frac{1}{8}$ through $\frac{1}{2}$ h.p., 115 or 230 volts; six-pole models from $1/10$ through $\frac{1}{2}$ h.p., 115 or 230 volts.

New Frigidaire Premises

Commenting on the new Frigidaire premises Mr. W. A. Porter said that this factory, formerly used by an electrical equipment manufacturer and which adjoins the Frigidaire factory, was now being rebuilt to accommodate a completely integrated research and laboratory unit with engineering test facilities and chemical and physical laboratories. Designed to develop and test refrigeration equipment it would, when completed, be the largest and most up-to-date unit of its kind in Europe. Also under construction were extensions to the Hendon factory including a large new sheet metal store, a paint store, and complete factory conversion from solid fuel to oil fired boilers. These are in addition to increased production facilities previously reported and completed since June 1957.

Referring to the launching of the programme in June, 1957, Mr. Porter said, "Our announced target then was to increase production of commercial refrigeration equipment by 1960 to 50% over what it was in 1956. In fact, we have already reached this first target with a year to spare, for the latest figures show that our production is now running at an annual figure 50.6% higher than that for 1956."

During the two years since the plan was launched, Frigidaire have also introduced eighteen new standard commercial products to their existing range as well as a whole series of new standard self-service display cases. They have also not only maintained prices but have made reductions wherever and whenever possible, the present reductions being the third series to be made since 1957.

Turning to exports, Mr. Porter said that although the export market was becoming increasingly competitive, the company was maintaining its good record in this direction and, in fact, annual exports of low temperature cabinets had increased since June, 1958 by no less than 26%. This, together with the increase achieved in 1957/58 meant that annual exports of low temperature cabinets had gone up in the last two years by a total of 51.2%.

In concluding his report Mr. Porter said that the company not only continued to be the largest manufacturer of commercial refrigeration equipment in Britain but had considerably increased its share of the market since the Frigidaire five-point development programme for commercial refrigeration was launched two years ago.

The present and future developments concerned

with expanding the factory and its engineering and productive facilities, meant that this share could be expected to increase still further in the next few years.

Controlled Temperature Environment Cabinet

CONTROLLED temperature conditions are becoming more and more important in engineering works as well as in research organizations. Lec Refrigeration Limited have considerable experience in producing sub-zero cabinets whose temperatures can be pulled down quickly and held accurately for long or short periods.

Every Lec cabinet is available with optional extras such as vacuum-sealed viewing windows, positive air circulation and instrumentation to meet any specialized requirements.

Their four standard models are as follows:—

Standard models.	Temp. range.	Capacity. cu.ft.
CL.15	Ambient to minus 73° C.	1.5
CL.30	Ambient to minus 73° C.	3
CL.15H	+121° C. to minus 73° C.	1.5
CL.30H	+121° C. to minus 73° C.	3

These cabinets are also made to any required specifications for any particular application. In one cabinet produced recently a temperature of minus 200° F. was reached.

The refrigeration system consists of either single, double or treble staging of compressors depending on the size and range of temperatures required, and charged with safe dependable refrigerants.

The controlled temperature environment cabinet has many uses including ageing, shrink fitting, hardening and stress equalization of metals. Research and testing of metal, plastics, rubber, lubricants, electrical equipment and instruments, etc., together with storage and preservation of chemicals, biologicals, sera, sperm and plasma. These cabinets are already in use both at home and abroad.

Manufacturers of refrigerators, refrigerating equipment and cold room plant etc., will be interested to know of a new paint specification which is admirably suited for the protection of tanks, cooling coils etc., in contact with aqueous solutions of refrigerants. The new specification has shown itself to be

entirely unaffected by over three months' immersion in monopropylene glycol and its resistance to the effects of sodium chloride and calcium chloride brines is likewise of a high order. The specification in question is one coat of Detel AD Grade Chromate Primer followed by two coats of Detel AD Grade Finish.

Both these materials are very specially formulated on a base of the highly resistant epoxy resins. The coatings are air-drying. In most instances, colour is not of importance for tanks and coils, but recently more and more enquiries have been received for finishes for new types of equipment and these finishes

are required to be of a more pleasing nature than the black bituminous types normally used. The manufacturers, **Detel Products Ltd.**, are pleased to advise that the AD Type specification quoted, can be supplied in a good range of colours to meet such demands. At the moment, white and cream seem to be most in demand.

JOINT SEALING COMPOUNDS IN THE REFRIGERATION INDUSTRY

By T. A. V. MEIKLE*

THE scope of this article is not a survey of sealing materials and problems in the manufacture of refrigerators or ancillary mechanical equipment but is intended to give an indication of some of the important functions for such materials in the industry and to describe some of the materials available.

In the construction of buildings such as cold stores the normal joint design considerations for a large building of any kind are applicable but obviously the working temperature of the interior of the structure is abnormal and this factor must be recognised at the design stage and in choice of materials for the joints.

In a conventional building, movement at joints is a combination of thermal and moisture movement in concrete and masonry and will continue throughout the life of the building. In the case of the cold store, in addition to these normal movements due to climatic changes, there may be considerable contraction when the building is put into service for the joint sealing compounds used have to be suitable for the period of construction, the transition period when the store is being brought down to its working temperature and for normal service conditions.

Typical joints of this type are expansion and contraction joints in a concrete floor. Bituminous compounds have been used for many years for this function but "straight run" or oxydised bitumens have a high degree of temperature susceptibility and tend to be hard and brittle at low temperatures. Specialized bituminous compounds containing rubber have been available for some years and have markedly superior properties. Rubber in bitumen reduces its temperature susceptibility and enables the compound to sustain considerable stresses even at low temperatures. Rubber bitumen sealing com-

pounds have been and continue to be used extensively in civil engineering and building and suitable grades are available for use in cold stores.

In certain types of construction such as basements integral water bars may be necessary in the joints of the concrete both in floors and walls since sub-soil water pressure could disrupt internal surface seals. Rubber and PVC waterstops are extensively used and special grades of PVC waterstops are available which are functionally satisfactory down to -50°C . The choice of type and size of waterstop will vary according to the particular site and service conditions and the manufacturer will be able to give guidance on the most appropriate section for a specific contract. These waterstops have largely replaced traditional metal waterbars which are subject to many disadvantages in performance and installation and this aspect has already been covered adequately in existing literature on the subject.

The efficiency of insulation materials as used in cold stores and refrigerated holds is seriously impaired if water vapour enters the media. An effective seal, therefore, is essential at joints in insulation sheathing and a vapour barrier is necessary on porous surfaces such as concrete, brickwork or masonry. Hot applied bitumen is widely used as a combined vapour barrier and adhesive for cork slab insulation. Some of the more recent insulating media such as expanded polystyrene need a cold applied adhesive/vapour barrier and a bitumen emulsion containing rubber latex may be used for this function.

The methods of sealing joints in insulation sheathing vary slightly but in principle a sealing compound is used between the butting edges of the sheets forming the sheathing and a metal cover strip. Mastics in paste form may be used; these are usually vegetable or mineral oil based with asbestos fibre and mineral fillers. An oil based mastic of this type will have good adhesion to most surfaces which are clean and dry and will retain its flexibility for prolonged periods. Application is normally by some form of extrusion gun but trowelling grades are available.

An alternative to paste type mastics are sealing compounds in strip form which are particularly suitable for cover strip applications. A product specially formulated for this function is an odourless rubber bitumen strip which has excellent adhesion under pressure and good low temperature flexibility. The material is easily handled despite the degree of surface tackiness which facilitates installation of this strip.

An unusual application for this product is in double or multiple glazed windows for frozen food cabinets. The strip in a suitable cross-section forms both the bond and hermetic seal between the sheets of glass and is normally employed in conjunction with a light alloy spacer. This application is a critical one for the sealing compound as it is subjected to shear stresses set up by differential movement of the separate sheets of glass and it must under these conditions maintain a perfectly air tight seal.

In such a short article as this it is not possible to deal with many other sealing problems which arise but it is hoped that the information given will be of interest to those concerned with the construction of cold stores and associated equipment.

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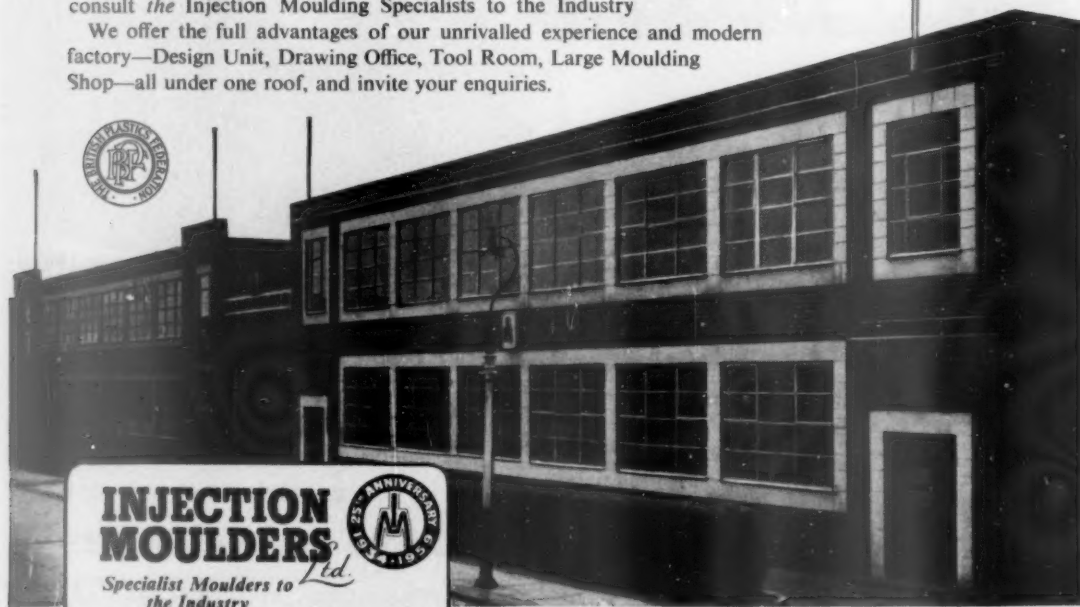
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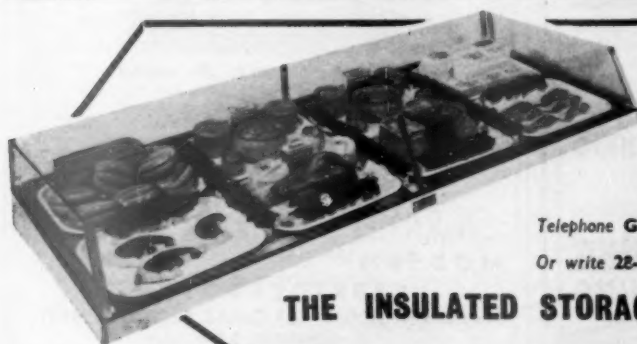


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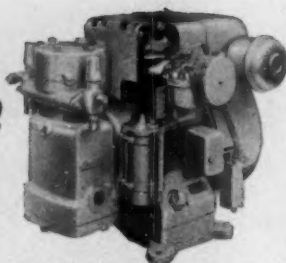
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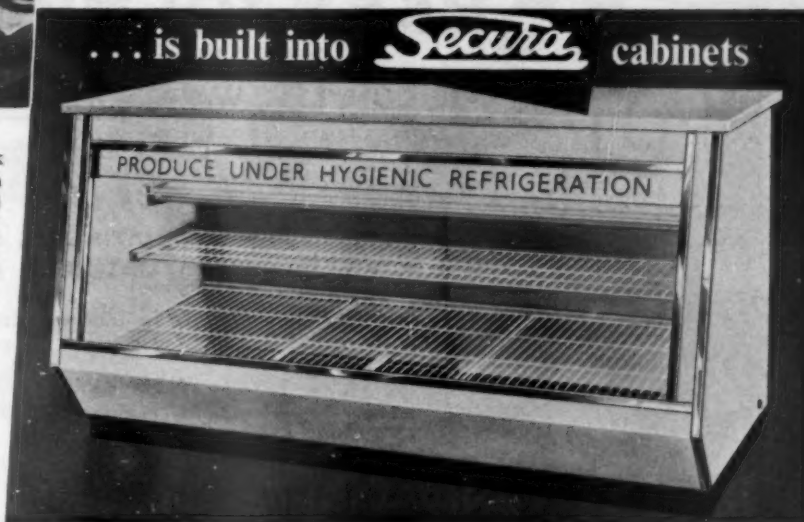


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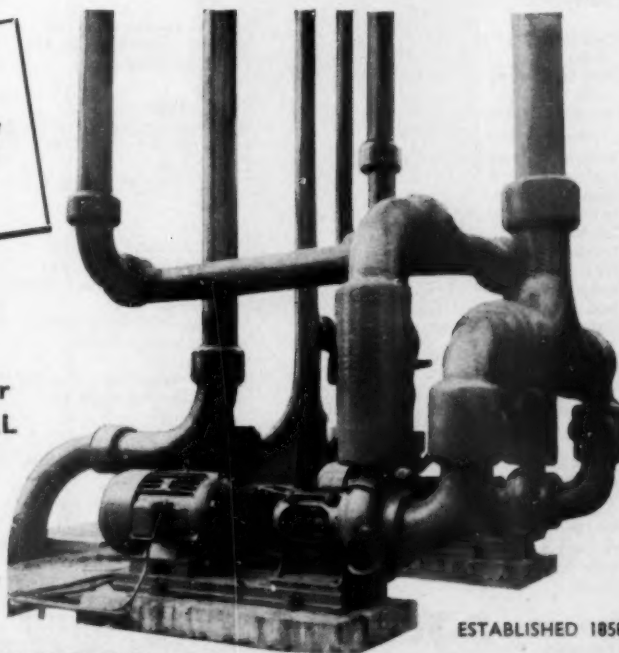
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Dutton (Leonard) & Sons	920	Metropolitan-Vickers Electrical Co. Ltd.	September	Visco Engineering Co. Ltd.	834
		Metzenauer & Jung GmbH.	September		
Eastwood Mill Co. Ltd.	915	Miller (Arthur) Ltd.	911	Wallington Jones & Co. Ltd.	836
Electrolux Ltd.	August	Minikay Ltd.	816	West (Ernest) & Beynon Ltd.	838
Elliott Bros. (London) Ltd.	September	MODERN REFRIGERATION 842, 845 & 916		West (W. Van) & Zonen	920
Ellis & Co. (Refrigerators) Ltd.	September	Monsanto Chemicals Ltd.	September	Western Detail Manufacturers Ltd.	827
Ether Ltd.	829			Western Ice & Cold Storage Co. Ltd., The	914
Expanded Rubber Co. Ltd.	818	Negretti & Zambra Ltd.	Cover iii	Westool Ltd.	September
		Newalls Insulation Co. Ltd.	September	White (J. Samuel) & Co. Ltd.	September
Frigidaire	September	Notley Ltd.	899	Whitaker (C. L.) & Co. Ltd.	September
Frozt-ed-Aer Refrigerators	838			Wigglesworth (Frank) & Co. Ltd.	900
Fylde Ice & Cold Storage Co. Ltd.	914	Patrick (W.) & Son Ltd.	900	Williams (G.) Engineering Co. Ltd.	September
		Perfection Parts Ltd.	September	Winget Ltd.	September
Gill (H.) Stampings Ltd.	923	Pertwee & Back Ltd.	899	Winn & Son Ltd.	899
Girdlestone Pumps Ltd.	910	Pilot Refrigerated Installations	841	Wood, L. D. (Eldwood) Ltd.	September
G.M. Power Plant Co. Ltd.	920	Pressed Steel Co. Ltd.	September	Worthington-Simpson Ltd.	September
Great Grimsby Coal, Salt and Tanning Co. Ltd.	August				
Gregson & Co. Ltd.	September	Ranco Ltd.	September	York Shipley Ltd.	Front cover
		Rapid-Ice-Freezing Ltd.	September	Yorkshire Imperial Metals Ltd.	823
		Refrigeration Appliances Ltd.	890		
		"Refrigerating Engineering"	920	Zero Electric Ltd.	900
		"Refrigeration Journal," The	920		

Keeping track of temperature

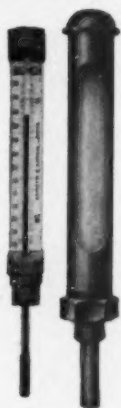
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Porcelain
Thermometer
for Cold Stores



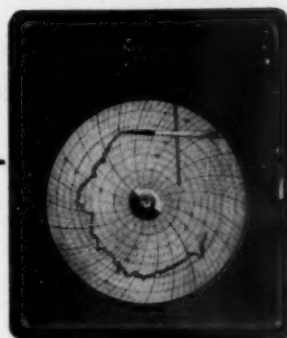
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Thermometer
for Refrigerated
Chambers



Brine Pipe
Thermometers



Dial Thermometer. Standard
Type for Cold Stores



"Mersteel" Temperature
Recorders. Standard Type
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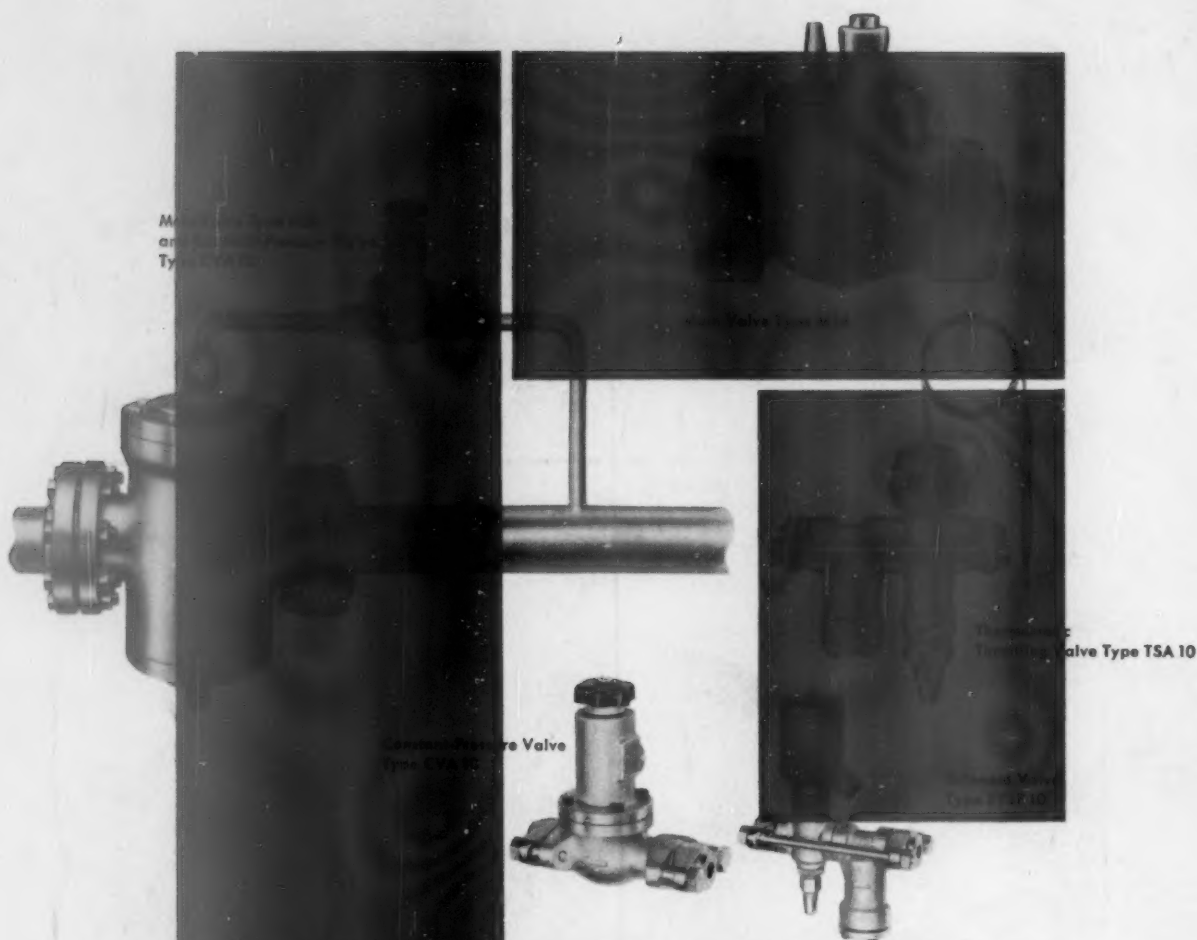


Multi-point Resistance
Thermometer

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DANFOSS SERVO-OPERATED BACK-PRESSURE REGULATORS

2031

..... are always made in two parts in order to make them as universal as possible—a main valve and a pilot valve, the latter being inserted in an equalising line between the suction line from the evaporator and the top of the main valve.

As the main valve may be governed simultaneously by several pilot valves mounted in the same pressure equalising line, the combination can simultaneously control:

- Constant evaporating temperature,
- Constant air temperature,
- Constant brine temperature.

If the pilot valve used is of the Type EVSP the main valve will act as a solenoid valve.

Danfoss

AUTOMATIC CONTROLS AND EQUIPMENT

COPENHAGEN . DENMARK



